The Franciscan Educational Conference

VOL. V. NOVEMBER, 1923 No. 5

REPORT

of the

FIFTH ANNUAL MEETING

CLEVELAND, OHIO

June 28, 29, 30, 1923

IN SANCTITATE ET DOCTRINA

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BLISHED BY THE CONFERENCE

Office of the Secretary
Herman, Butler County, Pa.

FIFTH MEETING OF THE FRANCISCAN EDUCATIONAL CONFERENCE, CLEVELAND, OHIO, JUNE 28, 29, 30, 1923.

LEFT TO RIGHT—FIRST ROW: 1. Gratian Meyer, St. Bernard, O. 2. Ferdinand Mayer (Vice-President), Syracuse, N. Y. 3. Felix M. Kirsch (Secretary), Herman, Pa. 4. Thomas Plassmann (President), Allegany, N. Y. 5. Joseph F. Rhode, Santa Barbara, Cal. 6. Gaudentius Rossmann, Marathon, Wis. 7. Andrew Maas. Floyds Knobs, Ind.

SECOND ROW: 1. Julian Duschinsky, Teutopolis, Ill. 2. Michael Harding, Allegany, N. Y. 3. Conradin Wallbraun. St. Louis, Mo. 4. Boniface Goldhausen, Mt. Calvary, Wis. 5. Conrad Reisch. Cleveland, O. 6. Cyprian Mensing, New York, N. Y. 7. Bernard Cuneo, Santa Barbara. Cal. 8. Conrad Link, Cincinnati, O. 9. Victor Mills, Paterson, N.J. 10. Simon J. Archambault Three Rivers, P.Q., Canada.

THIRD ROW: 1. Cuthbert Dittmeier, Rensselaer, N. Y. 2. Philibert Ramstetter, Louisville, Ky. 3. William Stehle, Hays, Kan. 4. Theodosius Foley, Yonkers, N. Y. 5. Hugh Tromp, Floyds Knobs, Ind. 6. Peter N. Nolan, Teutopolis, Ill. 7. Alfred Martin, Callicoon, N. Y. 8. Liberatus Presser, St. Louis, Mo.

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NIHIL OBSTAT.
FR. FELIX M. KIRSCH, O. M. CAP.
Censor deputatus.

IMPRIMATUR.
FR. HE[redacted] CAP.
[redacted]Min. Prov.
Pittsburgh, Pa., [redacted]

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OFFICERS

OF THE

Franciscan Educational Conference

Provincial Superiors

Very Rev. LEO GREULICH, O. M. C., Syracuse, N. Y.

Very Rev. JUSTIN FIGAS, O. M. C., Buffalo, N. Y.

Very Rev. JEAN JOSEPH DEGUIRE, O. F. M., Montreal, Canada.

Very Rev. JAMES MERIGHI, O. F. M., New York, N. Y.

Very Rev. EDMUND KLEIN, O. F. M., Cincinnati, Ohio.

Very Rev. TURIBIUS DEAVER, O. F. M., San Francisco, Cal.

Very Rev. MATTHIAS FAUST, O. F. M., New York, N. Y.

Very Rev. MARTIN STRUB, O. F. M., St. Louis, Mo.

Very Rev. FRANCIS MANEL, O. F. M., Pulaski, Wis.

Very Rev. BENNO AICHINGER, O. M. Cap., Detroit, Mich.

Very Rev. HENRY KLUEPFEL, O. M. Cap., Pittsburgh, Pa.

Officers of the Conference

Executive Board

President

Rev. THOMAS PLASSMANN, O. F. M.
Province of the Holy Name, New York, N. Y.

Vice-President

Rev. FERDINAND MAYER, O. M. C.
Province of the Immaculate Conception, Syracuse, N. Y.

Secretary

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Province of Santa Barbara, San Francisco, Cal.

Rev. HUGOLINUS BIFARINI, O. F. M.
Province of the Immaculate Conception, New York, N. Y.

Rev. CYRIL PIONTEK, O. F. M.
Province of the Assumption of the Bl. V. M., Green Bay, Wis.

Rev. RUDOLPH BONNER, O. F. M.
Province of St. John the Baptist, Cincinnati, Ohio.

Rev. THEODOSIUS FOLEY, O. M. Cap.
Province of St. Joseph, Detroit, Mich.

CONSTITUTION

OF THE

Franciscan Educational Conference

Adopted at the final meeting of the Franciscan Educational Conference, St. Louis, Mo., July 2, 1919.

ARTICLE I.

Name and Object

Section 1. The name of this organization shall be: "The Franciscan Educational Conference."

Section 2. The general object of this Conference shall be to safeguard the principles and to promote the interests of Catholic Education.

Section 3. The particular object shall be:

a) To encourage the spirit of mutual helpfulness and coöperation among the Friar educators of the American provinces;

b) To advance by study and discussion the Franciscan educational work in all its departments;

c) To offer means and incentives toward the advancement of learning and the pursuit of literary work among the Friars.

ARTICLE II.

Departments

Section 1. The Conference shall consist of three departments: The Classical, the Philosophical, and the Theological Department.

ARTICLE III.

Officers and Their Election

Section 1. The officers of the Conference shall be a President, a Vice-President, and a Secretary.

SECTION 2. These officers shall be elected separately, by secret ballot, in the last session of each convention, a simple majority deciding the successful candidate. If, after two ballots, no election has been effected, the two having the greatest number of votes shall be the exclusive candidates in the third ballot. In case two candidates receive an equal number of votes, the senior Friar shall have the preference.

ARTICLE IV.

DUTIES OF OFFICERS

SECTION 1. The President shall preside at all the meetings of the Conference and of the Executive Board.

SECTION 2. The Vice-President shall preside at these meetings in the absence of the President.

SECTION 3. The Secretary shall record and keep all matters pertaining to the Conference. He shall make due announcement of meetings and make the necessary preparation for them. He shall finish all the business of the previous meeting.

ARTICLE V.

THE EXECUTIVE BOARD

SECTION 1. The three officers afore-mentioned shall ex officio constitute an Executive Board.

SECTION 2. The Executive Board shall have the management of the affairs of the Conference. It shall be invested with power to make the regulations regarding the writing, reading, and publishing of the papers of the Conference meetings.

SECTION 3. It shall interpret the Constitution, By-Laws, and Regulations of the Conference and, in matters of dispute, its decision shall be final. It shall also have the power to appoint the various committees of the Conference.

SECTION 4. The outgoing officers shall finish all the business of the previous convention.

ARTICLE VI.

CONVENTIONS

SECTION 1. The Conference shall convene at such time, place and interval as may be determined by the Very Rev. Provincials in their annual meeting.

ARTICLE VII.

Amendments

Section 1. This Constitution may be amended by a two-thirds majority vote in any general session of the Conference, provided such amendment has been presented in writing and announced in a previous general session.

ARTICLE VIII.

By-Laws

Section 1. By-Laws which are not inconsistent with this Constitution may be adopted by a majority vote in any general session of the Conference.

Amendment

The Executive Board shall consist of the President, the Vice-President, and the Secretary. The afore-mentioned officers, in turn, shall designate as associate officers one member from each Province affiliated to the Conference, and not yet represented on the Executive Board.

INTRODUCTION

THE Fifth Annual Meeting of the Franciscan Educational Conference dealt with the subject of science. No one will doubt the timeliness of the subject. Ours is the scientific age. Science has wrought wonders in our age. It has made the dreams of yesterday the commonplaces of to-day. It has changed the forms of our civilization and has begun to change the face of the earth. It has filled man with the thrilling sense of expanding power. It has flooded his material environment with light, and has taught him to cast off the trammels of tradition, to become his own master through knowledge, to appraise things not in the light of their spiritual value but by their immediate usefulness to himself.

The schools of America have been deeply influenced by this progress of science. Science is pursued in the schools with passionate devotion. It has largely supplanted the old cultural subjects in importance, and would fain oust them completely.

In the face of this revolutionary change in education the schools of the Church have stood firm as strongholds of the old culture. They have bravely held their own against the onslaughts of modern science just as centuries ago they held out successfully against the inroads of medieval science.

But while we may not question the wisdom of this course we may, perhaps, ask whether certain church schools have not been ultra-conservative in ignoring the idol of modern education. It has even been asserted that Catholic scholars on the whole ignored science during the 19th and 20th centuries. This neglect was probably due to the fact that Catholic scholars had to defend their last line of defence — philosophy and theology — against the invasion of what Carlyle called the philosophy of mud—materialism. But as a result there arose the fable of the opposition between science and religion, and the clergy in general were kept out of touch with the scientific knowledge that has become the common property of the educated world.

The Popes have given warning of the dangers of this intellectual isolation. In his Encyclical "Longaeva," Pope Leo XIII. wrote: "An education which takes no notice of modern

science, can not be deemed complete. It is obvious that with the existing keen competition of talents and with the widespread, and in itself, noble and praiseworthy passion for knowledge, Catholics ought not to be followers, but leaders. It is necessary, therefore, that they should cultivate every refinement of learning and zealously train their minds for the discovery of truth and investigation, as far as it is possible, of the entire domain of nature. This in every age of the Church has been the wish of the Church; upon the enlargement of the boundaries of knowledge she has been wont to bestow all possible labor and energy." Pope Pius X., in his Encyclical "Pascendi," of Sept. 8, 1907, mentioned the study of the sciences as one of the chief weapons to be employed against Modernism, and insisted that the seminaries give particular attention to this subject. In his letter to the clergy of Czecho-Slovakia Pope Benedict XV. made the same demand. On May 10, 1922, Pope Pius XI. addressing the members of the International Astronomical Union and of the International Geodetic and Geophysical Union, declared: "The science which you profess is one of the most beautiful and most noble of all the sciences: it is a guide to that Truth which ought to be the object of all our desires. You are familiar with the laws, the grandeur, and the harmony of the universe; and this knowledge inspires you with admiration for its wonderful structure. Hence it is that you worship the Creator, and you ought rightly to be more closely attached to Him than those who know little or nothing of His marvelous handiwork." The new Code of Canon Law has made ample provision for the study of science with its insistence in Canon 1364, No. 3, that the clergy be educated according to the general standard prevailing in the country of their prospective field of labor.

This patronage of the sciences on the part of the Popes is in keeping with the best traditions of former centuries when churchmen were the pioneers and leaders in the several sciences. It behooves us, then, as Catholic educators to investigate whether we have really made the most of the cultural advantages inherent in science study so that the graduates of our schools may be fully abreast of the times and able to stand their ground in any general scientific discussion. Our course of study need therefore not slight the old cultural subjects but should so coördinate them with the modern subjects that the

students of our schools may combine with their classical training a thorough understanding and an intelligent appreciation of the undoubted achievements of modern science. The sciences must form an integral part of the education of every prospetive Franciscan priest, and if properly taught they will train him to think in the terms of the modern age and to speak the accents familiar to the men and women of the present day.

But reasons over and above those mentioned should urge us to provide for the training of specialists in science. Many specious arguments against the ancient faith have been drawn from modern science. Hence the current opinion of the conflict of science and faith. But to correct this erroneous opinion and to refute the specious arguments drawn from science we need theologians who are at home in Scholastic philosophy as well as in science. Philosophy alone is inadequate as a means of defence. Spencer and Hartmann wrote on evolution from the viewpoint of the philosopher, and accomplished nothing with the masses. Haeckel—a philosophical nonentity because lacking the first principles of logic, but eminent in his own special field of zoölogy—had the world at his feet, chiefly because there were so few on the Catholic side who were his equals in natural science. The need of the hour is a large number of men of the stamp of Gutberlet, Wasmann, Schanz, Muckermann, Plassmann, Pohle who, each in his own field of the sciences, could meet the foe on his own ground.

Hence we must train specialists in science for the purpose not only of teaching in our schools but also of defending the foundations of faith against certain scientists. Men may write ponderous tomes upon the subject of apologetics and fill them with historical, philosophical, and theological proofs for the doctrines of faith; yet one single "truth" from science will, in the eyes of the masses, shatter the whole array of arguments. But an apology such as Schanz produced that takes into account the very latest achievements of science, is irrefutable in the eyes of the modern man. The man in the street regards the "truths" of physical science as absolute and proved. He does not know what the scientific worker realizes that these "truths" are for the most part only probalilities, of a higher degree doubtless than most statements swallowed as gospel in daily life, but still unproved, and perhaps incapable of rigorous proof.

What harm has been done to the faith of millions by irresponsible writers on evolution! The Catholic position was weak because there were so few theologians trained scientifically to separate the chaff from the wheat, and to proclaim and to defend the truth. On this score, too, we may learn from the Middle Ages. Albert the Great was considered a revolutionary scientist in the 13th century. Yet St. Thomas was his closest friend and learned from Albert the respect that the theologian must have for the facts that scientific and human research present, though he insisted at the same time upon he revision to which scientific interpretation must submit before revealed truth.

The religious Orders have a special duty in this regard. An eminent Catholic scientist has pointed out the fact that the Catholic layman and the secular clergy likewise are often prevented by the care for material needs to devote themselves to scientific investigation, but that the religious with his material needs provided for by his community may venture carefree into the labyrinths of scientific studies. The Benedictine Foundation for Scientific Research as projected for the Catholic University of America by the Rev. Dr. Thomas Verner Moore, has been conceived in this spirit. Nor will the Franciscan Friars fail the Church in this regard. Let those among them who possess an apitude for these things, delve deep into the study of science so that their conclusions will command the respect of scholars everywhere. Other Friars with a more general training and with a gift for popular appeal should turn to the specialists in science for the material to spread the knowledge of scientific truth among the masses, and to offset, for instance, some of the baneful effects of the "Feature Section" of the Sunday newspapers.

These are some of the problems that engaged the attention of the Friars during their Fifth Annual Meeting held at the Monastery of Our Lady of the Angels in Cleveland, Ohio, from June 28th to June 30th, 1923. It is hoped that the papers and discussions may throw some light upon what is at the present time a difficult problem for all Catholic educators. For the Friars themselves the present Report may serve as a guide in their attitude towards modern science.

In looking over the pages of the Report the writer is deeply impressed with the adaptability of the Friars to the needs of

the times. The Friars are members of an Order founded some seven hundred years ago by a man who had become an outcast for Christ. And in these busy, achieving days of twentieth century America, his sons hold a meeting to discuss how they may best prove both men of faith and men of science, and their deliberations are evidence that they have kept up to the minute with the rapid progress of science and civilization.

Still the Report represents only one phase of the many-sided activity of the Friars. It may be news for some to learn that over two thousand Friars are enrolled under the banner of St. Francis in this country. Their prayers and good works, their preaching and teaching, their countless ministrations embracing every form of priestly activity and Franciscan charity should be a power in bringing home to our countrymen the Gospel of Christ and the example of one of his most devoted followers—the Poor Man of Assisi. Not to speak of the twenty-one educational institutions in the hands of the Friars, we need refer only to the large sphere of influence controlled by the eleven Franciscan periodicals with a combined circulation of 496, 201 subscribers and over 2,500,000 readers. Other avenues for exerting a similar holy influence are the Poor Clares, the fifteen thousand Sisters of St. Francis, and the more than one hundred thousand Tertiaries. Verily what a power for good is here!

About forty years ago Tennyson exclaimed: "Sweet Saint Francis of Assisi, would that he were here again!" Might it not almost seem as though the wish of the Protestant poet had come true in America? The Lord has, indeed, blessed the children of St. Francis in the New World, and it must be our ceaseless prayer that we may not prove unworthy of the sublime trust committed to our weak hands. Quod faxit Deus!

Franciscan Educational Conference

First Session

Cleveland, Ohio, June 28, 1923, 8:15 P. M.

THE first session of the Fifth Annual Meeting of the Franciscan Educational Conference was called by the Rev. Thomas Plassmann, President of the Conference, on June 28, 1923, at 8:15 P. M., in Duns Scotus Hall, in the Franciscan Monastery of Our Lady of the Angels, Cleveland, Ohio.

There were present: Rev. Columban Valentin, O. F. M., Cleveland, O.; Rev. Thomas Plassmann, O. F. M., Allegany, N. Y.; Very Rev. Joseph F. Rhode, O. F. M., Santa Barbara, Cal.; Rev. Peter N. Nolan, O. F. M., Teutopolis, Ill.; Rev. Conrad Reisch, O. F. M., Cleveland, O.; Rev. Julian Duschinsky, O. F. M., Teutopolis, Ill.; Rev. Gerard Schmalz, O. F. M., Cleveland, O.; Rev. Gratian Meyer, O. F. M., St. Bernard, O.; Rev. Michael Harding, O. F. M., Allegany, N. Y.; Rev. Cyprian Mensing, O. F. M., New York, N. Y.; Rev. Conrad Link, O. F. M., Cincinnati, O.; Rev. Philibert Ramstetter, O. F. M., Louisville, Ky.; Rev. Liberatus Presser, O. F. M., St. Louis, Mo.; Rev. Bernard Cuneo, O. F. M., Santa Barbara, Cal.; Rev. Conradin Wallbraun, O. F. M., St. Louis, Mo.; Rev. Simon Joseph Archambault, O. F. M., Three Rivers, P. Q., Canada; Rev. Victor Mills, O. F. M., Paterson, N. J.; Rev. Alfred Martin, O. F. M., Callicoon, N. Y.; Rev. Ferdinand Mayer, O. M. C., Syracuse, N. Y.; Rev. Andrew Maas, O. M. C., Floyds Knobs, Ind.; Rev. Hugh Tromp, O. M. C., Floyds Knobs, Ind.; Rev. Cuthbert Dittmeier, O. M. C., Rensselaer, N. Y.; Rev. Anthony Hodapp, O. M. C., Terre Haute, Ind.; Rev. Antonio de Castillo, O. M. Cap., San Juan, Porto Rico; Rev. Boniface Weckmann, O. M. Cap., Herman, Pa.; Rev. Theodosius Foley, O. M. Cap., Yonkers, N. Y.; Rev. Gaudentius Rossmann, O. M. Cap., Marathon, Wis.; Rev. Boniface Goldhausen, O. M. Cap., Mt. Calvary, Wis.; Rev. William Stehle, O. M. Cap., Hays, Kan.; Rev. Felix M. Kirsch, O. M. Cap., Herman, Pa.

The Rev. Columban Valentin, O. F. M., welcomed the Friars to the hospitality of the Monastery of Our Lady of the

Angels, and assured them that he deemed it a high honor to greet the representatives of the three branches of the Order of St. Francis who had come to Cleveland from far and near to labor in the cause of Franciscan education. Fr. Columban concluded his address of welcome by invoking the blessing of Heaven upon the meeting: "May our Immaculate Mother, our Seraphic Father St. Francis, and our Seraphic Doctor St. Bonaventure be in your midst and intercede for you at the throne of Light and Mercy so that your deliberations may be blessed by the Lord and redound to the benefit of our Seraphic youth and the greater glory of our Order and the Church."

The Rev. Chairman, Fr. Thomas, responding to these gracious words voiced the gratitude of the Conference for the cordial welcome extended. He told of the kindly hospitality that the Friars had received at Our Lady of the Angels but two years since, at the Duns Scotus Meeting, and recalling some of the achievements of that gathering he expressed the hope that even greater things would be accomplished this year. What gave him particular confidence was the enlarged membership of the Conference since it had grown during the past two years from a body representing only seven Provinces of the Capuchins and Franciscans to include eleven Provinces of the Capuchins, Conventuals, and Franciscans so that all the jurisdictions in the United States and Canada are now affiliated with the Movement.

The minutes of the Fourth Annual Meeting were adopted as printed in the Report, and the Secretary was accorded a vote of thanks for his laborious task of editing the publication.

The Secretary submitted the following report:

The Conference printed 1,100 copies of the Fourth Annual Report which were received with much appreciation as was evidenced by the large number of commendatory letters not only from the Superiors of the Order and members of the Hierarchy, but also from many educators at home and abroad. The periodical press was also generous in its reviews of the Report and in its notices of the work of the Conference. In consequence there was a heavy demand for the Report among the members of religious communities of both men and women.

But the active interest of our Confrères has been even more gratifying. The Friars at home have been kind and

generous in their coöperation with the work and aims of the Conference. Individual Provinces have been encouraged by the example of the larger body to hold educational meetings for the purpose of coördinating more closely their several courses of study. And in other countries also have the Friars been very sympathetic with our Movement. The Report of the "Erste Lektorenkonferenz der deutschen Franziskaner," published in 1922, contained several laudatory references to the activities of the American Friars who were said to have led the way in organizing inter-provincial meetings. At the 1922 Meeting of the German Provincials, the Very Rev. Provincial, Fr. Raymond Dreiling, O. F. M., referred graciously to the intellectual intercourse established by the Franciscan Educational Conference between the German and the American Provinces. The American Friars were represented by the Rev. Berard Vogt, O. F. M., of St. Bonaventure's Seminary, Allegany, N. Y., at the second meeting of the German Lectors held at Carlowitz-Breslau in August, 1923.

The Friars of Brazil have likewise followed the example of the American Provinces by holding inter-provincial meetings and publishing the reports of their proceedings.

The Provinces of Belgium are planning to inaugurate a similar movement, and the Friars in Italy, Spain, and Malta are known to be entertaining similar plans but may be prevented for the present by their destitution from carrying out their projects. Thus the work of the Franciscan Educational Conference is being approved in a way that represents the sincerest form of flattery—imitation.

Our Holy Father, Pope Pius XI., has graciously accepted a specially bound set of the four Annual Reports and has generously given the book a place in his Library. The Most Reverend Generals of the Conventuals and Capuchins have added their approval of the Conference to that of the Most Reverend General of the Franciscans, and hence the Friars have for their endeavors the blessing of their highest Superiors. Our Provincial Superiors have continued loyally in their support of the Conference and have generously seconded all our efforts in behalf of Franciscan education. The total expenses of the Conference for the past year were $881.85.

The following communications were read by the Secretary:

SECRETARIO DI STATO
DI SUA SANTITA
NO. 18373

Dal Vaticano, 30 Maggio 1923.

REV.MO PADRE:

Ho il piacere di significarle che il SANTO PADRE he ricevuto con vivo compiacimento l'omaggio di filiale devozione che la P. V. Revma ha voluto fargli, coi quattro volumetti "Report of the Annual Meeting" della "The Franciscan Educational Conference."

SUA SANTITA mi ha incaricato di farle giungere i Suoi sovrani ringraziamenti, mentre di cuore Le invia l'Apostolica Benedizione.

Mi valgo intanto della presente occasione, per raffermarmi con sensi di distinta e sincere stima

di V. P. Revma
Affmo nel Signore
P. CARDINAL GASPARRI.

To the Very Rev. Fr. Felix M. Kirsch, O. M. Cap.,
Secretary of the Franciscan Educational Conference,
Herman, Pa., U. S. A.

CURIA GENERALIS FF. MINORUM CAPUCINORUM
VIA BONCAMPAGNI, 71
ROMA (25)

Romae, die 1. Septembris 1923.

ADMODUM REVERENDE PATER,

Attentam nostrorum sollicitudinem in sacerdotali juventutis nostrae efformatione curanda plene laudamus, precamurque bonorum omnium Largitorem, ut tot conatus felici exitu coronare dignetur.

Quae sit mens nostra hac in re, elapso anno in litteris encyclicis ad universum Ordinem missis luculenter exposuimus. Summopere exoptamus ut Religiosi nostri ordinationibus ibi contentis sese in dies conformare studeant; compertum enim Nobis est, illas litteras a Suprema Ecclesiae Auctoritate approbari, ideoque nec nobis nec nostratibus ab ea deflecti licet.

Summa caritas, quae SS. Doctores Angelicum et Seraphicum, Thomam et Bonaventuram simul conjunxit, Thomistarum et Franciscalium scholas indissolubili nexu uniat, et juvenes nostri non tantum ex seraphico unius amore, sed et ex angelico alterius lumine fructus abunde colligant et catholicae sapientiae sibi thesaurum acquirant. Sanctum sit apud eosdem Thomae nomen, vereanturque non sequi eum, quem bene scripsisse de se Ipse Jesus Christus testatus est.

Suprema Ecclesiae Auctoritas nova documenta circa Thomae doctrinam paulo ante, recurrente hoc sexcentesimo anno ab eius canonizatione, publici juris fecit. Summus Pontifex mentem suam sine cunctatione aperit et statuit: "Sanctum . . . unicuique . . . esto quod in Codice juris canonici praecipitur (can. 1366, No. 2) ut "philosophiae rationalis ac theologiae studia et alumnorum in his disciplinis institutionum professores omnino pertractent ad Angelici Doctoris rationem, doctrinam et principia, eaque sancte teneant; atque ad hanc normam ita se omnes gerant ut eum ipsi suum vere esse possint appellare magistrum" (Encyclica: "STUDIORUM DUCEM," 29 Junii 1923). Nobis, qua Franciscales, alacriori promptiorique animo Summi Pontificis voluntas amplectenda est.

Bona omnia Tibi et Patribus, qui in juvenum salutari efformatione laborant, a Domino adprecamur ac Nos omnioum orationibus maxime commendamus.

P. T. A. R.
Addictissimus in Domino
FR. JOSEPHUS ANT. a PERSICETO, O. M. Cap.
Minis. Glis.

Adm. Rev.do P. Felici a Wheeling,
Professori O. Min. Cap.
Herman, Pa.

NATIONAL CATHOLIC WELFARE COUNCIL,
THE HIERARCHY OF THE UNITED STATES,
DEPARTMENT OF EDUCATION.

Washington, D. C., Dec. 1, 1922.

DEAR FATHER KIRSCH:—

I received the Report of your Fourth Annual Meeting. It is very well done.

I was particularly interested in the article on the History of Franciscan Dogmatists. Don't you think this ought to be pamphletized and sent out to our Colleges?

Many thanks.

Yours very sincerely,
JAMES H. RYAN, Executive Secretary.

THE AMERICAN CATHOLIC HISTORICAL ASSOCIATION,
OFFICE OF THE SECRETARY,
THE CATHOLIC UNIVERSITY OF AMERICA,

Washington, D. C., Dec. 6, 1922.

MY DEAR FRIEND:—

Hearty felicitations on the Report of the Fourth Annual Meeting. The discussion is exactly what I hope one day to reproduce in the Association.

I am,
Very sincerely yours,
PETER GUILDAY.

UNIVERSITAS LITTER. FRIDER. GULIELM. RHENANA,

HOCHWUERDIGER, SEHR VEREHRTER HERR PATER!

Ich danke Ihnen herzlich fuer die liebenswuerdige Zusendung des neuen Report der Educational Conference. Der Beratungsgenstand dieser letzten Tagung liegt mir allerdings ferner und getraue mir kein Urteil darueber zu. Doch habe ich mit Interesse die Verhandlungen gelesen und auch daraus gelernt. Die Ausfuehrungen Euer Hochwuerden S. 68f. leuchten mir ein, und dem, was Fr. David ueber die Behandlung der Kirchengeschichte sagte (S. 71f.), kann ich nur zustimmen. Im allgemeinen erquickt uns Menschen im alternden Europa und besonders im ungluecklich zertretenen Deutschland das frische wissenschaftliche Leben, das unter den Katholiken jenseits des Ozeans herrscht und nicht am wenigsten aus den Blaettern blickt, die wir vorzueglich Euer Hochwuerden verdanken. Wie schoen ist

es in der katholischen Einheit, dass, wenn der eine Zweig dahin welkt, der andere um so mehr Blueten treibt und so der Stamm gesund bleibt. Und kommt die werkaetige Liebe hinzu, so schoepft auch das Absterbende neuen Mut.

Mit ehrerbietigen Empfehlungen
Ihr ganz ergebener,
DR. H. SCHROERS, Professor der Theologie.

SULPICIAN SEMINARY, CATHOLIC UNIVERSITY OF AMERICA.

Washington, D. C., Dec. 30, 1922.

DEAR REV. FATHER:—

I wish to thank you for the Report of the Fourth Educational Conference of the Franciscans which you so kindly sent us. We are trying to make a collection of works concerning clerical education, and your reports are valuable additions to it. Personally I can say that I have read the contributions to the former numbers with interest and profit.

With sincerest good wishes for a very happy and prosperous New Year, I am, my dear Father,

Yours very respectfully,
J. B. TENNELLY, S. S.

ST. STANISLAUS' HOUSE,
BROOKLYN STATION,

Cleveland, Ohio, March 9, 1923.

REVEREND DEAR FATHER:—

I thank you cordially for the copy of the Report. I looked up the reference to co-operation among religious bodies in this Report and agree most heartily with the Archbishop's statement. We can all learn something from others, as I can testify from the perusal of your Reports.

I read Fr. Albert O'Brien's paper in your Report, and found that point after point in our little pamphlet was brought up by him and treated in the same spirit as we conceived it. I was delighted and at once wrote to Fr. Albert and sent him a copy of our Library Report. Fr. Coan's paper, or rather treatise, impressed me very favorably. The historical bibliography is a capital idea. I can appreciate the time and energy that it must have cost Fr. Sabinus!

Yours very sincerely in Domino,
HENRY H. REGNET, S. J.

Werthae, Holland, 16. Jan., 1923.

ADM. REV. PATER,

Gratum animi nostri sensum manifestamus Paternitati Vestrae quod misisti nobis exemplaria quibus continetur relatio quarti conventus ad promovendam educationem vere franciscalem habiti anno 1922 vertente mense Junio.

Spiritu eminenter catholico simul et scientifico discussum fuisse novimus methodum docendi conscribendique historiam. Inter consilia perutilia quae proposita fuere non ultimum certo locum occupat illud quo adornandus edicitur catalogus librorum qui in variis cujusque notus, R. P. Z. Engelhardt, O. F. M., egregie ostendisse videtur, quam Provinciae bibliothecis prostant. Disserens, in re historica optime

late pateat campus pro historiographo Missionum qui digne celebret merita Confratrum qui saeculis anteactis Ordinis decorem promoverunt.

Celare non possumus jucundum animi sensum quem experti sumus legentes singulorum disserentium enthusiasmum seraphicum quo ad indefessum laborem scientificum spiritu franciscali suscipiendum excitant. Magno cum plausu excepimus consilium assignandi inter disciplinas fratribus clericis tradendas locum privilegiatum historiae Ordinis. Specialis lector hujus disciplinae jam antea designatus fuit in hac nostra Provincia.

Liceat denuo significare desiderium quod jam expressimus ante hoc tempus. Nostro quidem judicio optandum foret, ut relationes conventuum qui quotannis apud Vos habentur ad promovendam educationem franciscalem lingua latina exaratae divulgarentur, e. g., in periodico "Acta Ord. Min.," cum plurima contineant universo Ordini perutilia utpote aptissima ad explendas lacunas hac in re omnibus manifestas.

Addmus in Domino
FR. SIMON BENNENBROEK, O. F. M., Min. Prov.

Romae, 12. Dec., 1922.

CARISSIME CONFRATER,

Tibi ceterisque carissimis triplicis Seraphicae Familiae confratribus summas ob utillimos Conferentiarum labores congratulationes, de oblato IV. vol. grates ex corde, laetissimaque Natalitia omina insecabilis fraternae charitatis, mente et corde unitatis in Verbo Incarnato, in quo "commendando malo excedere quam deficere" — B. Joannes Duns Scotus, Oxon.

Obmus addmus confrater
FR. MARIANUS FERNANDEZ GARCIA, O. F. M.

CONVENTO DOS FRANCISCANOS,

Petropolis, Brazil, den. 29. April, 1923.

HOCHWUERDIGER LIEBER PATER!

Durch Vermittlung des Hochw. H. P. Marianus Winzen, des hiesigen Lektors der Dogmatik, erhielt ich den Report of the Fourth Annual Meeting. Die einzelnen Referate bildeten fuer mich eine hoechst genussreiche Lektuere und ich kann Ihnen die Versicherung geben, dass wir Lektoren der noch relativ jungen Provinz mit steigendem Interesse die aeusserst zeitgemaessen Bestrebungen der nordamerikanischen Franziskaner auf dem Gebiete der Erziehung verfolgen. Den Ideen und Resolutionen der Franciscan Educational Conference gebuehrt die weiteste Verbreitug, und es waere sehr zu wuenschen, dass dieselben auch in den suedamerikanischen Franziskanerprovinzen ihren Einfluss geltend machten.

In caritate seraphica
Ihr sehr ergebener
P. THOMAS BORGMEIER, O. F. M.

Mexico City, Dec. 19, 1922.

DEAR FATHER FELIX:—

I thank you cordially for your kind thoughtfulness in sending me a copy of the Report. The Report is a delightful surprise. After reading it with deep pleasure, I had to confess: This is true Franciscanism, full of life and energetic virtue. What a lesson for many

in the Old World, for they may well turn to the Friars in America for living exemplars of the true spirit of St. Francis. Hearty congratulations upon the splendid success.

Yours fraternally,
FR. JAIME DE LA COT, O. M. Cap.

ST. BONAVENTURE'S CAPUCHIN HOSTEL,
Cork, Ireland, April 4, 1923.

DEAR REV. FATHER:—

I desire to acknowledge with many thanks the receipt of the two Reports of 1921 and 1922.

It is gratifying to find that amid all your labors, you can find time to discuss the improvement of education; and especially that you have set an example to the Friars of other Provinces to place Duns Scotus once again in his true place in the History of Philosophy.

With every good wish for the success of your work, I remain,
Fraternally yours,
BR. HILARY, O. S. F. C.

After these preliminaries the Chairman introduced the subject of this year's meeting. He explained that as the Friars had in previous meetings discussed the curriculum in general and then taken up certain subjects in particular, it was incumbent upon the Conference to give attention to the subject that had long been clamoring for treatment—the sciences. The sciences have been growing in importance during the past few decades, and many educators are even fearing lest they oust the classics from their time-honored pre-eminence in general education. On the other hand, the professors of philosophy, especially those who have caught the spirit of the neo-Scholastic Revival at Louvain, are justly demanding that more attention be given to the sciences. Hence to meet their wishes and at the same time to allay the fears of the classicists the Conference had to take up the sciences for the double purpose of widening and improving the teaching of the subject, and of assigning to it its proper place in the curriculum. True, the sciences had been dealt with at the St. Louis Meeting, in 1919, in connection with the curriculum, but it seemed the part of wisdom to re-examine the subject in the light of the experience gained since then. Hence the Chairman suggested that a Committee be appointed for the purpose of first studying the problem in detail and then reporting its findings at a later session when the subject might be discussed by the whole Conference. The following Friars were asked to serve on this Committee: Frs. Joseph (Chairman), Gaudentius (Secretary), Philibert, Gerard, Cuthbert, Andrew, Boniface (Goldhausen).

Friars Bernard, Theodosius, and Ferdinand were appointed the Committee on Resolutions; and Friars Victor and Bernard, the Committee on Press and Publicity.

The Conference was now ready for the first paper on "Science in the Franciscan Order, a Historical Sketch," by the Rev. John M. Lenhart, O. M. Cap., of Pittsburgh, Pa. In the absence of Fr. John, his paper was read by the Rev. Boniface Weckmann, O. M. Cap., Rector of St. Fidelis' Seminary, Herman, Pa.

It was remarked after the reading of the essay that the Friars were fortunate in having this historical paper to inaugurate their discussions on the sciences. he paper was a glorius proof that in stressing the sciences the Friars were not taking up a new subject, but were preserving what was their noble heritage of the ages. Still the members of the Conference admitted that the paper was a revelation to them in proving that the sons of St. Francis had always been among the pioneers in science. Though all were conscious of the splendid history of the Franciscan Order, none had dreamed that so vast an array of eminent scientists could be found among the followers of the Poverello. Hence it was said that the Conference and the Order as a whole owed a debt of gratitude to Fr. John for delving into the records of the past and unearthing the names and the deeds of the Friar-scientists that had been forgotten by their own confrères. Nor is it the least merit of Fr. John's dissertation that its form and scholarship are such as will command universal respect.

It was decided to discuss Fr. John's paper in the morning, and after hearing a few opinions about the subject to be treated at next year's Conference the Friars adjourned at 10:45 P. M.

Second Session

CLEVELAND, OHIO, June 29, 1923, 8:30 A. M.

IN taking up the discussion of Fr. John's paper on "Science in the Franciscan Order," the Friars recalled that the first Franciscans inspired by St. Francis' love for his brothers and sisters in nature were pioneers in the natural sciences. While the Dominicans legislated locally against the study of the sciences, the Franciscans submitted to the influence of Roger Bacon and legislated in favor of science study in their

General Constitutions of 1292. Some time was spent in recounting other services that Roger Bacon rendered to science, and details were given of the celebration held at Oxford on June 10, 1914, to commemorate the seven hundredth anniversary of the birth of the illustrious Franciscan.

It was found to be a truly Franciscan trait that the science studies of the Friars invariably served a practical purpose. The sons of St. Francis regarded their knowledge of the sciences as a means for increasing their usefulness in nursing the sick, especially the lepers. The Friars also prized their knowledge of the sciences as a means for making their preaching more effective and for tracing more clearly the foosteps of the Lord in His visible creation. Their ideal was that of their Seraphic Father who classed the flowers and birds with his brothers and sisters, the sun, moon, and stars—all members of the sacred choir praising God.

Fr. John had admitted regretfully that Franciscan science was at a low ebb during the 19th and 20th centuries. This may seem strange after the brilliant record of the preceding centuries. But the discussion stressed the fact that the Friars were affected by the untoward conditions of the time. The French Revolution and the subsequent secularization had swept away so much of the ancient institutions that the attention of Catholic scholars was concentrated almost exclusively upon what they regarded as their last stronghold—the philosophical and theological disciplines. This situation was unfortunate as the period was remarkable for passionate and often exaggerated devotion to science. And it is only because the theologians neglected the sciences that the fable of the opposition between science and religion could obtain such wide acceptance among the masses. Hence Catholics and non-Catholics are now in need of researches of the kind of Father John's essay so that they may see the demonstration of the historical fact that many of the greatest scientists in the history of the world were faithful sons of Mother Church. This historical fact was brought out clearly in the discussion of the relationship between science and religion.

It was thought opportune to record also the names of Franciscan Tertiaries — such as Columbus, Galvani, Galileo, Volta — who had rendered eminent service in the domain of science.

The paper of Fr. John had called attention to several lacunae in the history of Franciscan science, and the Friars were urged to make further researches in the rich field. Their efforts would be rewarded with valuable finds, and thus they would be serving the cause of historical truth, enhance the glory of the Order and the Church, and provide material to inspire the present age, so proud of its achievements, to emulate the glorious achievements of the past. "Laudemus patres nostros et gloriosos nostros," may well be the motto of our historical investigators.

The Conference approved, in this connection, of the scholarly monograph of the Rev. Francis Borgia Steck, O. F. M., "Who First Explored the Mississippi River?" In this work Fr. Francis proved that Joliet and not Marquette was chiefly responsible for the exploration of the river after the Spaniards under De Soto had discovered it about one hundred and fifty years before. Fr. Francis' treatment of the subject was commended as a model for all scholars who would from original documents disprove popular misconceptions of historical truth. It gave pleasure to the Friars to hear that Fr. Francis is engaged on a history of the Franciscan Order to be used as a textbook in our clericates. Fr. John M. Lenhart was also reported as being working on a history of the Capuchin Order.

The historical activity of these Friars should be an incentive to their confrères to take up similar tasks. The paper read at the first session had made reference to Fr. Thomas Plassmann's monograph on Bartholomaeus Anglicus, and Fr. Thomas took occasion to tell of his experiences while working on that subject. The subject had been assigned to him while he was still a cleric, but he confessed that he grew so deeply interested in the matter that he re-wrote the monograph twenty-five times. Whatever library he got to, whether in Louvain, Rome, or Bonn, he would look for material on Bartholomaeus Anglicus. Eventually he had a mountain of notes, but he had incidentally learned very much more than merely the life and works of his hero.

Nor was his experience at all singular. After Fr. Alphonse Coan had completed his learned treatise on "Franciscan Dogmatists," he admitted that he had found twenty other subjects to write about. Fr. John M. Lenhart's experience had been similar, for throughout his dissertation he indicated topics

that might profitably engage the labors of studious Friars. It was encouraging to hear that Fr. Albert O'Brien, O. F. M., had undertaken to treat one of these topics, namely, the mathematical studies and writings of Roger Bacon.

These discussions led up logically to the problem of how to elicit more literary activity among the Friars. At the Convention of the Catholic Educational Association, several speakers had brought up this very subject as affecting the American clergy in general. Reference was made at the Convention to a religious Order that has produced much scholarly work in Europe but is in that regard doing absolutely nothing on this side of the Atlantic. The same charge may be made against more than one religious Order, and to a certain extent against the whole body of Catholics in our country.

The Rev. Albert C. Fox, S. J., President of Marquette University, quotes a Catholic professor of Columbia University as having said: "In spite of the Church's amazing growth, American Catholics have had no such influence upon the thought and life of the whole nation as their numbers would lead us to expect." The cruel truth of this statement is patent to those who have studied developments in America during the past twenty-five years. The fact that our Catholics do not lead is painfully obvious. In a graduation address delivered last June, Professor Carlton J. H. Hayes of Columbia, himself a convert to Catholicism, had the following to say: "The greatest need among Catholics, in my humble opinion, is the need of intellectual leaders. We boast of twenty million Catholics in this country, but how many of them are scholars and scientists, artists and critics? There are more intellectual leaders among the three million Catholics in Ireland and even among the two million Catholics in England than among the whole twenty million in the United States. Yet without a large and vigorous intellectual class we shall never influence profoundly the life and thought of America." The Franciscans are hence face to face with what is a universal complaint.

What the Church in America needs most urgently is, as the Rev. Dr. John Cavanaugh, C. S. C., puts it, "writers thoroughly familiar with Christian principles to spread the truth through the apostolate of the printed word. We need men of science

who have won secure and lofty places among the savants of the world and who can go into learned assemblages and into the modern universities and say in accents that command conviction: 'I have studied apes as well as you, but I have also studied angels; and I know by the laws of science as well as by the laws of philosophy that man was made, as the prophet says, a little lower than the angels and not, as some scientists say, a little higher than the apes'."

The present time offers unusual opportunities for spreading the truth not only in this country but in the world at large. If we would bring the influence of Catholic truth to bear upon the world, we must act now when this country bids fair to assume the intellectual leadership of the world. In his latest book, "The Life and Confessions of a Psychologist" (New York, 1923), Dr. G. Stanley Hall speaks of the intellectual leadership enjoyed by Germany, and continues: "To-day this leadership is gravely impaired and possibly forever shattered, and it is craven and imbecile not to see that the situation brings a new call to this country, now the richest and most prosperous in the world—spending more money for education than all Europe combined—to aspire to this succession, to pay back our intellectual debt, and possibly to bring the keystone of the intellectual arch to this country." Hence if we would make the influence of truth felt throughout the world, we must act now.

In this matter our main hope lies in the young generation of the Order. Our young Friars must be trained for literary and scholarly craftsmanship. St. Bonaventure's Seminary, Allegany, N. Y., has set a noble example with its "Year Book" which was inspired by its President, Fr. Thomas Plassmann, O. F. M., and produced by its diocesan and Franciscan students. The Capuchin students of Cumberland, Md., have similarly set a high mark with their publication of "India and Its Missions." It may be hoped that our young men if trained along such lines will be infected for life with the *cacoethes scribendi,* and that they will ever after feel an irresistible craving to write for the public.

It has been said that it is the instinctive prompting of the born writer that is responsible for most of the books we have to-day. But with 22,000 priests in the country and 16 universities, 114 colleges, and 51 seminaries under the control of

the Church, the amount of Catholic productive scholarship remains so pitiably small that it must be the lack of encouragement and training of the born writers that is responsible for the dearth of Catholic books in English.

The Conference therefore agreed that the Friars would be promoting a large cause if they found ways and means to cultivate in America that scholarly and literary activity that are characteristic of the Catholic clergy and laity in some other lands. It was declared that individual initiative would be unequal to the task, and hence the Conference should look about for organizing a body of learned and enterprising Friars who would know not only our needs but also the men who could meet those needs. In this way systematic and concerted action might produce results commensurate with the number and the undoubted ability of our Friars. Plans should be made for a series of books to meet certain needs. English Catholic literature is painfully inadequate, and there is not any department of learning that is adequately represented. True, we may as yet lack the men to produce standard books in certain departments. But much good might be done even now by translating standard works from other languages.

Still the Conference hesitated about taking final action on this matter, but decided to take preliminary steps that would eventually lead up to the organizing of such a directive committee and in the meantime offer an incentive and an opportunity to the Friars to engage more extensively in literary work. It was agreed that we make a beginning with reprinting some of the historical papers read at different meetings of the Conference. Scholars within and without the Order had expressed the wish for a wider circulation of these treatises, and incorporating them into a series of "Franciscan Studies" would give them this wider publicity. However, the series should not be narrowly historical, but should welcome contributions on any topic of interest to the educated reader, though the Franciscan writers would naturally be expected to treat all subjects in that practical, original, and individual manner that has come to be acknowledged as a characteristic of all things Franciscan.

Instead of inaugurating a periodical it was felt to be safer and wiser to begin a series of articles to be published at irregular intervals in as far as the demand and the supply would warrant. The example of the Goerresgesellschaft was adduced

as favoring this policy for the beginning. The Catholic Unity League of Canada and "La Verna" in Italy also began in this modest way and ultimately accomplished great things. The Friars of Saxony began their "Franziskanische Studien" in a similar way until their success warranted their present quarterly. In France, Italy, Germany, and Spain the Friars are publishing scientific periodicals, and if this can be done with only one branch of the Order, and in certain cases only one Province, supporting the several publications, what may we expect of the "Franciscan Studies" sponsored as they will be by eleven Provinces of the three branches of the Order and published in the land of infinite possibilities!

In launching their new publication the American Friars could learn from the successes and failures of similar ventures in the Old World, and so avoid some of their mistakes. Hence it was decided to broaden the scope of the publication lest it appeal to the narrow clientele of the "Archivum Franciscanum Historicum." It was also found advisable to have all the Provinces belonging to the Conference represented on the editorial board of the new publication. The experience of the "Archivo Franciscano-Iberico-Americano" had taught the wisdom of this policy. Though it had an able editor, the periodical almost died for lack of support until associate editors from several Provinces were added to the editorial staff.

The final outcome of the long discussion was the decision to inaugurate a series of monographs to be known as "Franciscan Studies," the individual issues to appear at irregular intervals, and the first number to be published in January, 1924. The Delegates representing the several Provinces were asked to agree among themselves about the associate editors to represent their respective Provinces and to report their choice at a later session. It was also decided to compile a list of the Friars in the United States and Canada who would be capable and willing to write for publication. The academic training and previous publications of these writers were also to be noted, and the complete list was to remain on file in the office of the Secretary of the Conference. In this way the Friars might hope to establish a Republic of Letters of their own, and afford an opportunity to scholars within and without the Order for closer coördination of effort. The list of writers was duly reported to the Secretary, and it was found that the prospect-

ive "Franciscan Studies" could count upon a large corps of capable writers for scholarly contributions.

The following is the list of associate editors as agreed upon by the respective Delegates:

Fr. Bede Hess, O. M. C., Province of the Immaculate Conception, Syracuse, N. Y.; Fr. Cyril Kita, O. M. C., Province of St. Anthony of Padua, Buffalo, N. Y.; Fr. Joseph F. Rhode, O. F. M., Province of Santa Barbara, Cal.; Fr. Victor Mills, O. F. M., Province of the Holy Name, New York, N.Y.; Fr. Ferdinand Gruen, O. F. M., Province of the Sacred Heart, St. Louis, Mo.; Fr. Robert Moore, O. F. M., Canadian Province of the Friars Minor, Montreal, Canada; Fr. Ermin Schneider, O. F. M., Province of St. John the Baptist, Cincinnati, Ohio; Fr. Sixtus Ligario, O. F. M., Province of the Immaculate Conception, New York, N. Y.; Fr. Cyril Piontek. O. F. M., Province of the Assumption of the Blessed Virgin Mary, Green Bay, Wis.; Fr. Theodosius Foley, O. M. Cap., Province of St. Joseph, Detroit, Mich.; Fr. Felix M. Kirsch, O. M. Cap., Province of St. Augustine, Pittsburgh, Pa.

The editor-in-chief was to be elected by ballot from among the associate editors, and Fr. Felix M. Kirsch, O. M. Cap., having been thus elected, Fr. Francis Laing, O. M. Cap., was chosen to represent the Province of St. Augustine as associate editor.

Mr. Joseph F. Wagner, of 23 Barclay St., New York, has agreed to publish the "Franciscan Studies," and he is planning to have the first issue ready for distribution early in December. We are confident that this enterprise will meet with the hearty approval of our Superiors; and we invite the Friars of the various Provinces to coöperate in making the undertaking a success. We trust that the following letter written by a Seminary Professor who is favorably known throughout the country for his scholarly writings, is representative of what we may expect of the clergy and the Catholic laity generally.

ST. CHARLES' SEMINARY

Overbrook, Pa., Oct. 21, 1923.

DEAR FATHER KIRSCH:—

I have just received the Report and given it a rapid survey. Its wealth of content is really remarkable; there is as much research embodied within its covers as one usually expects only in heavy tomes. What you are doing in your meetings constitutes a valuable contribution to American Catholic education. It is something of which

not only you, but the whole American Church has every reason to feel proud.

It is a great pity that these solid and instructive discussions are not accessible to a larger audience. Much profit could be derived from them. You Franciscans are by far too modest. The material that is stored up in the Reports of your Conferences represents a great intellectual wealth which others would clamorously advertise.

With keen anticipation I look forward to the "Franciscan Studies." Such original investigations bring new life to our philosophical studies which are in a fair way of completely stagnating.

I sincerely wish you every success, and hope that Francscan thought will come to be better recognized in our midst.

Thanking you for your kindness, I remain,

Fraternally yours,

CHARLES BRUEHL.

After a brief recess, the Friars re-assembled to hear the Rev. Boniface Goldhausen, O. M. Cap., of St. Lawrence's College, Mt. Calvary, Wis., read his paper on "The Cultural Aspect of the Sciences."

The Chairman expressed the gratitude of the Conference for the paper that gave unmistakable evidence of hard labor and clear thinking. A particularly pleasant feature of the paper was its beautiful language. A scientist who could speak in such beautiful language of the cultural aspect of the sciences, furnished strong evidence for the truth of his plea.

Before entering upon the discussion proper, the Friars discussed the precise meaning of the much-abused term "science." The history of the word was traced from Aristotle and through the Middle Ages down to our time. The discussion was the fruit of wide and thoughtful reading and is reproduced hereinafter in full as an object-lesson to teachers to be careful themselves and to train their students to be no less exact in the use of words. Father Faber complained in his day that people did not know the meaning of common words, and there is obviously more reason at the present time and in this country for the complaint of the great English writer.

An important part of the paper had dealt with the practical value that science has for the priest engaged in the cure of souls, and additional points were mentioned to illustrate that the American priest, whether in the pulpit or in the confessional, at the sickbed or on the lecture platform, whether abroad or at home, has abundant use for a thorough knowledge of the sciences. The books of Fr. Augustine Gemelli, O. F. M., show convincingly how the confessor may employ science in diagnos-

ing and treating the ills of certain souls who otherwise may easily be misunderstood and hence misdirected in matters most intimately connected with their ultimate happiness. Physicians have also expressed the wish that priests should know more about biology and bacteriology as this knowledge would assist them in protecting themselves and others against infection.

After agreeing to have the various Committees meet at 1:30 P. M., the Friars adjourned at 11:50 A. M.

Third Session

Cleveland, Ohio, June 29, 3:00 P. M.

THE Most Reverend Dominic Tavani, O. M. C., D. D., Minister General of the Friars Minor Conventual, made a brief stop in Cleveland at noon. A delegation of Friars had gone to the railroad station to present to the Most Rev. General the respects of the Conference and to request him to honor our Meeting by his presence. The distinguished visitor approved cordially of the work of the Conference, but expressed his regret that an urgent appointment with a Bishop in the East made it impossible for him to remain long enough in Cleveland to visit Our Lady of the Angels.

Encouraged by the message from the Most Reverend General the Friars resumed their discussion of Fr. Boniface's paper. The cultural value of science was brought out by the fact that it responds to various interests of human nature and that its study is therefore needed to round out the education of the young. Science study also offers wholesome relief to the student occupied with historical or speculative subjects. While admitting the educational advantages of the systems in natural history, the Friars urged the study of the so-called life-units because these offer an opportunity for coördinating the sciences with the humanistic disciplines and also for eliciting real sympathy with nature. Certain sciences were said to be essential to the man who would understand modern life. Without a knowledge of science the priest lacks the thought-forms and language-forms to communicate effectively with the world of to-day, and will never be able to realize the thrilling sense of expanding power which modern science gives to men.

But to bring out these cultural values the methods of science teaching must be reformed in many schools. While insisting

on the need of laboratory equipment and the use of experimentation and observation, the discussion emphasized the importance of the scientific method for all science teaching. Logical development and the spirit and method of scientific research must characterize our science teaching. The antipathy of many students to science was traced in large part to the lifeless methods of teaching the subject. Illustrations were given of both the dead and the live method of teaching science. The problem of correlating science with other branches of the curiculum, especially with philosophy, also received some attention. An eloquent plea was made for correlating mathematics with the classics, and it was shown that both subjects will gain by the whole-hearted coöperation of the two departments.

The opinion was finally advanced that over and above the cultural value of the sciences they are a necessity to-day for any one who would lay claim to a general education. Furthermore if properly taught they will always prove interesting because they deal with the tangible and satisfy man's inborn curiosity about his natural environment. In the hands of a capable teacher the sciences are an alluring subject: at the Catholic University of America professors and students from all departments were wont to flock to the biology classes of a certain professor.

The Friars re-convened after a brief intermission to hear the Rev. Peter N. Nolan, O. F. M., Sub-Rector of St. Joseph's College, Teutopolis, Ill., read the paper on "Equipment and Research Work in the Sciences," which had been written by the Rev. Aloysius Fromm, O. F. M., Ph. D., Lector of the Sciences at Our Lady of the Angels, but teaching at the time of our Meeting at the Catholic University Summer School, Oakland, Cal.

The Chairman remarked after the reading of the essay that the Conference might congratulate itself upon having elicited from the noted Franciscan scholar and pioneer in scientific research work this able presentation of a timely subject. The author had demonstrated that he was familiar with the very latest developments in laboratory equipment, but he adapted his demands to our peculiar needs and modest resources. He conceived his paper in the spirit of the old Franciscan saying, "A Friar should carry about nothing but his lyre." But his paper also recalled the principle of Fr. David Fleming, O. F.

M., "A Friar must be poor, but may not study poorly." In corroboration of Fr. Aloysius' modest demands the discussion referred to the example of eminent scientists who accomplished much with small means.

The Chairman declared that the paper would be used as a guide in his Province where the Friars faced the situation of equipping a new laboratory and remodeling another. The information given by Fr. Aloysius would advise the authorities about what was best and also most economical, and thus would save that one Province thousands of dollars. The members of the Conference were invited to visit the laboratories of Fr. Aloysius and found them to be, indeed, concrete illustrations of the wise directions given in the paper.

School museums were also discussed, and they were said to offer opportunities to all teachers, but especially to science teachers, for vitalizing their several subjects. An account was given in this connection of the paleontological collection made by the theology students of Cumberland, Md. Reference was also made to the Rev. Cornelius Pekari, O. M. Cap., who succeeded after years of patient collecting in furnishing the museum of St. Fidelis' Seminary, Herman, Butler Co., Pa., with a collection that is fairly representative of the fauna of Butler County.

This subject of making collections gave occasion for discussing the policy of encouraging the special aptitudes of our clerics. The Franciscans have been known from the beginning for their fostering the individuality of the Friars. This policy has borne fruit in the originality of all that the Order has ever accomplished. In keeping with this tradition it was said to be advisable to ascertain the special abilities of all our clerics and then to encourage them to develop these aptitudes. Though all our clerics must, of course, take the general course of study, it is not wise to confine them to this curriculum. Instead, they should be encouraged to use their leisure moments to follow their own bent of mind and to devote themselves to those subjects to which their special abilities incline them. In this way they will be trained to use their leisure for useful pursuits, and this training will serve them in good stead during their priestly life, and result eventually in work that may mean much for the Order and the Church. If we bear in mind the old axiom of the Friars, "Qualis Frater, talis Pater," we shall be mindful

of the duty to train our clerics to use their leisure for developing the talents that the Lord has given them for His greater glory and the benefit of our fellowmen.

This discussion proved illuminating, but could not exhaust the very important topic, and it was therefore agreed upon to devote a paper to the subject at our next meeting. For a valuable treatment of the subject, the Friars were referred to the paper of the Rev. Raymond Dreiling, O. F. M., on the "Erziehung unserer Kleriker zur Arbeitsfreudigkeit," read at the first educational meeting of the German Franciscans. Fonck's "Wissenschaftliches Arbeiten" (a book that should have been translated into English long ago) also contains much information that will assist our lectors in this regard.

Fr. Aloysius had treated the subject of laboratory equipment so exhaustively that further discussion of his paper was dispensed with, and the meeting adjourned at 5:10 P. M. to allow some time for the meetings of the various Committees.

Fourth Session

Cleveland, Ohio, June 29, 8:15 P. M.

THE Chairman opened the session by explaining that as the Friars had heard all the papers on the program, they were now in a position to discuss the subject of the sciences as a whole. He also remarked that it would be in order to examine any objections that might be offered against allowing so large a scope in our curriculum to the study of the natural sciences.

There was one obvious objection that the greater attention to the sciences would only increase the evil of our overcrowded curriculum. However, while the evil was not minimized it was maintained that the evil itself was at least as old as the Middle Ages. In the days of Friar Roger Bacon the curriculum was very much overcrowded and the students were in worse plight than our pupils. The "Summas" were the storehouses of all knowledge, but they were not available in the large editions of our textbooks. Consequently the students had to frequent many libraries, consult the ponderous tomes, and copy as much as their overworked fingers would allow. What they could not get on paper they had to carry in their memory. Hence the medieval insistence on memory training and mnemotechnical

devices. At all events the medieval student had to work harder than his modern brother.

Though the modern course of study is, indeed, overcrowded, the remedy does not lie in dropping essential or even integral parts of the curriculum. Instead, the burden must be lightened by improved methods of teaching and by teaching the students the art of study. The worst possible way of handling the situation would be to allow the students to follow the line of least resistance and to neglect, under the plea of overwork, whatever is not to their liking. The teacher must remain true to his high calling and make his pupils realize that as in all other fields of human endeavor so in science study, too, only hard labor can bring success: "Nil sine magno vita labore dedit mortalibus."

Other current objections against science study, whether coming from classicists or philosophers or theologians, were examined in detail. But the general impression seemed to be that there is no immediate danger of the Friars' overemphasizing the science course. There is really more danger of conceiving the course of liberal education in too narrow a spirit; and it is just because of the one-sidedness of so many classicists that many graduates of church schools are ignorant of the elementary ideas of biological science and remain perfect ignoramuses in all other sciences of nature. But being ignorant of these modern subjects they can not understand the life around them and can hardly secure a hearing in the modern world. True, by amalgamating the classics with the sciences we are liable to fall into all the dangers of what Paulsen called Utraquismus, but we avoid this pitfall by taking up the intensive study of the sciences during the philosophy course.

The cultural advantages of mathematics and its interrelations with other sciences were fully discussed. It was asserted that the course in mathematics would gain if it were so arranged as to lead up to the elements of spherical astronomy. Such a course would be reviving an admirable practice of the medieval schools. It would also be better rounded off and more compact than anything we have at present. By aiming at something definite and tangible it would bring out the connections between mathematics and other interests and studies. With such a course, the priest, too, would never have reason to complain as did Carlyle: "Why did not somebody teach me the

constellations and make me at home in the starry constellations which are always overhead, and which I don't know to this day?"

The Friars also discussed ways and means for correlating the natural sciences with the sacred and moral sciences. It was also pointed out that there would be less opposition of the classicists to the sciences if the latter were more closely correlated with the language studies. The science teacher should therefore, first of all, insist in his classes on the correct use of language, and should train his pupils to realize that to describe an experiment properly and clearly is almost as difficult as to make it. He should likewise respect the ancient languages not merely for their having contributed almost the entire terminology of science, but also for enabling us to utilize the researches of the older scholarship. Without a knowledge of the classical languages one can not study the history of any science; and the historical treatment of scientific problems is no less important than the experimental study of them. A continued neglect of the scientifico-historical element and, therefore, also of the philosophical element of the so-called exact sciences must, despite all other increase, result in their impoverishment and decline.

Granted for the moment that the future belonged to the so-called exact sciences, still their representatives could never dispense, aside from the philosophical element, with the command of language, for this is the sole medium for expressing what they have found; and there can be no doubt that the proper use of this medium demands as much exactness as the researches themselves. Furthermore, the representatives of these sciences could never dispense with the historical review of their respective discipline with its achievements and failures, for such a review is the sole guarantee for the proper continuity of the work of research. Now both these obvious needs are met through the aid of the languages, and so the A B C of the latter remains part of the equipment needed for every science, even the most modern.

Fr. Boniface had good grounds for correlating the sciences with the classics. Our knowledge even of the sciences is conditioned on classical antiquity, and Fichte could rightly say, "The ancients are the repositories of the scientific world." No

science can dispense with the terms it has borrowed of the ancients. But the sciences have borrowed of the ancients more than a large part of their terminology. Boeckh has well said: "Antiquity contains the roots and beginnings of all disciplines, the primitive concepts, and, we may say, the elementary knowledge of mankind; these elements naturally prove the proper subject for early school education. The rudiments are especially important; they generally embody the most spiritual, the principle, which will often in later treatment be obscured unless one revert continually to the elements." These beginnings, however, are of a philosophical nature, and to neglect them estranges the mind from the basic element of philosophy; but this is very harmful as the philosophical element is the unifying bond of all science. (Willmann, "Science of Education," Vol. II, pp. 108f.)

But the language teacher on his part should also be intent on correlating his subject with the sciences. He should not forget that the scientific terminology implies a large increase in the pupils' vocabulary. Furthermore, the content of the science course will make for greater language power in as much as it increases the material knowledge and gives the pupils something to speak and write about. The language teacher should take this knowledge increase into account when assigning themes for oral or written composition.

There is no dearth of models in this respect. We have in English many books written on science that are real literature. Tyndall, Thoreau, Muir, Burroughs, W. H. Hudson, Beebe, Fabre (in the splendid translation by Alexander Teixeira de Mattos) have written on scientific subjects in a way that will appeal to the man in the street. To quote just one instance: Dr. Richard A. Muttkowski, an alumnus of St. Lawrence's College, Mt. Calvary, Wis., has in a striking passage told us of the rich feast that awaits the reader of Fabre's works:

> I could tell of the many wonders and curiosities, of lovers, of fighters, of devoted parents, of artisans and craftsmen, of records of fasting and records of feasting, of bacchanals and orgies, of monsters, of robbers and ghouls, of the multitude of types as they pass in lordly review in Fabre's pages. Are you a mathematician? Then read of those adept mathematicians, the spiders, in the "Life of the Spider." Are you interested in surgery? Then read of those keen surgeons, the wasps, in the "Hunting Wasps." Are you a home builder, a parent? "The Life and Love of Insects," "The Sacred Beetle," and "Social Life of Insects" will tell you of homes, of love, of splendid

parenthood. For pomp and pageant read of the processionaries in the "Life of the Caterpillar;" for barbarian and gruesome feasts learn of that consummate hypocrite, the praying mantis, in the "Life of the Grasshopper." This is the amazing fact that impresses the reader: those insects, those spiders, that multitude of small life we pass by so carelessly in our routine life, each has its individuality, its special history peculiar to itself and repeated by few other species. Read where you want, open the page where you will: there are thrills awaiting you. But if you would also appreciate the master's fine humor and irony then be sure to begin with the "Life of the Fly," for otherwise you will miss many of the allusions contained in other volumes. The "Life of the Fly" contains a good deal of the fly, the insect, but also a good deal of that other "Fly," Fabre himself, so nicknamed by his colleagues at Ajaccio.

Fabre and the other scientists mentioned above have "clothed the ungainly and rigid specter of science in the warm flesh and blood of human sympathy, they have robed her in the rustling garments of silken and silver language, and have given her the lustrous eye of poetry and the brave voice of honest and thoughtful prose." Let the science teacher himself read widely in such books, and he will then be able to direct his students wisely in their scientific reading, and they may thus learn how to treat scientific subjects without any reminder of the ill-smelling laboratory, i. e., in a broadly human and appealing way.

The meeting adjourned at 11:10 P. M.

Fifth Session

Cleveland, Ohio, June 30, 9:00 A. M.

THE convention photograph was taken at 8:30 A. M. At 9:00 A. M. the Friars met in Duns Scotus Hall to hear the Very Rev. Joseph F. Rhode, O. F. M., Prefect of Studies of the Santa Barbara Province and Chairman of the Committee on Program, present the Report on the science course. The Committee had made a thorough study of the subject but did not find much to change in the program as adopted at the St. Louis (1919) Meeting of the Conference.

The reading of the Report was followed by a general discussion, and it was found that the course as outlined did ample justice to the requirements of the ecclesiastical authorities as well as the standardizing agencies, and hence was adopted as read with only a few slight changes. The broad modifications of the program will allow each Province to arrange its

course to meet the needs of its several institutions or the requirements of the respective state authorities.

With regard to state recognition it was said that there was much unnecessary alarm in certain circles. On the whole, the state authorities and standardizing agencies are fair in their demands. But if ever their demands should conflict with what we feel is demanded by the Church or our own needs, we must not fail to stand upon our rights. Hence the wisdom of remaining closely aligned with the Catholic Educational Association and the National Catholic Welfare Council which have wielded so powerful an influence in safeguarding the Catholic interests in education.

In connection with the program for the science course, it was interesting to hear Fr. Simon explain why the Canadian Friars had been somewhat neglectful, as he said, of the sciences. For this attitude he blamed the traditional apathy of French Catholics against the sciences, as well as local conditions. But he likewise contended that his Confrères would have to take more kindly to the sciences, especially in view of their work of training missionaries for the Far East.

The question was asked whether the science course as outlined by the Conference would not conflict with the philosophy studies. But it was stated on the grounds of experience that the intensive study of science does not prevent our clerics from properly appreciating the problems of philosophy. However, it was remarked that the science teacher must be on his guard lest he overburden his students with such special tasks as investigating problems or writing papers.

To prevent such overburdening it was thought advisable for all the teachers of one department, or even of the whole school, to confer periodically, or at least occasionally, about the course of study, the tasks to be assigned, and kindred questions. The success of the Franciscan Educational Conference was cited as an argument in favor of these faculty conferences. If the Friars representing all the Franciscan schools of the country profit by the annual meetings at which they exchange their views, it will assuredly redound to the good of the schools to have similar meetings for the individual faculties, or perhaps for all the teachers of a Province. Comenius found that one boy sharpens the genius of another boy more than any one else can, and the same is true of the

benefit accruing from the formal and informal exchange of views provided for in teachers' conferences. Some of the Friars told of such conferences held in their schools with great gain for teachers and taught, and also referred to the example of teaching communities of men and women in which such pedagogical conferences are obligatory at periodical intervals.

The science teachers were informed that the Science Service, 1115 Connecticut Avenue, Washington, D. C., publishes a weekly "Science News-Letter" (annual subscription five dollars) under the control of the American Association for the Advancement of Science, the National Academy of Sciences, and the National Research Council. This publication supplies the latest news of scientific progress in non-technical language.

The Friars adjourned at 11:45 A. M.

Sixth Session

Cleveland, Ohio, June 30, 8:00 P. M.

FATHER Conradin Wallbraun, O. F. M., and the Friars of Our Lady of the Angels had kindly arranged an automobile tour of Cleveland for the afternoon. The tour included visits to several churches, notably to the beautiful Church of St. Agnes, and to several educational institutions.

In the evening the Friars met for the closing session. It was thought proper to draw up a list of books written by our Friars during the past year or so, and the very creditable list is appended herewith:

Ameringer, Thomas, O. F. M., Ph. D.
The Stylistic Influence of the Second Sophistic on the Panegyrical Sermons of St. John Chrysostom. Washington, D. C., 1921.

Buisson, Pacifique, O. F. M.
Un Triple Souvenir de Brouage a Sainte-Anne de Ristigouche. Quebec, 1922.

Capuchin Mission Unit of Cumberland, Md.
India and Its Missions. New York, 1923.

Cloutier, Urbain M., O. F. M.
Propos Japonais. Quebec, 1921.

Cuneo, Bernard, O. F. M., S. T. D.
The Lord's Command to Baptize. Washington, D. C., 1923.

Duerk, Hilarion, O. F. M.
Report of the First National Third Order Convention. Chicago, Ill., 1922.

Duns Scotus Theological Society.
Year Book of St. Bonaventure's Seminary. Franciscana Press, St. Bonaventure, N. Y., 1923.

Emanuel, Cyprian, O. F. M., Ph. D.

The Social Work of St. Vincent de Paul. Washington, D. C., 1923.

Engelhardt, Zephyrin, O. F. M.
San Luis Rey Mission. San Francisco, 1921.
San Juan Capistrano Mission. Los Angeles, 1922.
Santa Barbara Mission. San Francisco, 1923.

Fobique, Hugolin, O. F. M.
Bibliographie du T. O. Seculier de S. Fran. au Canada. Montreal, 1921.

Foley, Theodosius, O. M. Cap.
The Making of a Capuchin Priest. New York, 1922.
The Capuchin Lay Brother. New York, 1922.
The Invincible Prefect. New York, 1923.

Ilg, John, O. F. M.
The Franciscan Lay Brother. Teutopolis, Ill., 1922.

Kirsch, Felix M., O. M. Cap.
Translator of Willmann's Science of Education. Two vols., Archabbey Press, Beatty, Pa., 1921-1922.

Longpre, Ephrem, O. F. M.
Theoogie Mystique de St. Bonaventure. Quaracchi, 1922.
Philosophie de Scot. Etudes Franciscaines, Paris, 1922.

Mollaun, Romuald, O. F. M., S. T. D.
St. Paul's Concept of Ilasterion. Washington, D. C., 1923.

Ohleyer, Leo, O. F. M., S. T. D.
Induere Christum according to St. Paul. Washington, D. C., 1921.

Peloquin, Bonaventure, O. F. M.
Debuts d'un Missionaire. Quebec, 1921.

Rhode, Joseph Francis, O. F. M., Ph. D., S. T. D., S. S. L.
The Arabic Versions of the Pentateuch in the Church of Egypt. St. Louis, 1922.

Schaaf, O. F. M., J. C. D.
The Cloister. Washington, D. C., 1921.

Steck, Francis B., O. F. M.
Glories of the Franciscan Order. Chicago, Ill., 1921.
Fray Junipero Serra and the Military Heads of California. Chicago, Ill., 1922.

Grateful mention was also made of the literary contributions of our Friars to the periodical press. The Conference singled out as worthy of special commendation the monthly contributions to the "Homiletic and Pastoral Review" by the Rev. Stanislaus Woywood, O. F. M., whose book, "The New Canon Law" (New York, 1918) is so deservedly popular among the priests of the country. Nor did the Conference forget the valuable services rendered to the general Catholic public by the Franciscan magazines: "Crusader's Almanac" (English, German, Polish, Italian), Washington, D. C.; "Franciscan Herald," Chicago, Ill.; "Third Order Forum," Chicago, Ill.; "The Franciscan," Paterson, N. J.; "St. Antony's Almanac," Allegany, N. Y.; "Seraphic Chronicle," New York; "St. Antony Messenger," Cincinnati; "Der Sendbote," Cincinnati; "La Revue Franciscaine," Montreal, Canada; "Mie-

siecznik Franciszkanski," Pulaski, Wis.; "Poslaniec sw. Franciszka," Pulaski, Wis.; "Seraphic Home Journal," Pittsburgh, Pa.; "Seraphischer Kinderfreund," Pittsburgh, Pa.

Mention was also made of three Friars who have been called to offices of high honor since our latest meeting. Fr. Edwin Auweiler, O. F. M., Ph. D., has been called by the Most Reverend General to the College of St. Bonaventure in Quaracchi, Italy, where he is to join the Board of Editors as the first American representative. No doubt he will take an active part in the projected critical edition of the "opera omnia" of Duns Scotus. The Conference agrees with the learned editor of the "Fortnightly Review" that this is a field of labor for which Fr. Edwin is particularly well equipped. It is pleasant to note that with Fr. Edwin's appointment the Conference is witnessing the carrying out of the Resolution it passed at its Duns Scotus Meeting in 1921 when it offered "both men and means for expediting the critical edition of the works of our Franciscan Masters."

Fr. Claude Mindorff, O. F. M., has similarly been called by the Most Reverend General to the International College of St. Anthony in Rome where he is to teach Philosophy and English Literature. Fr. Claude will be gratefully remembered by the Friars for his deep and helpful interest in the Conference from its very beginning, and for his kindly services rendered on different occasions as our "Official Photographer." Like Fr. Edwin he has given repeated proof since his sailing for Italy that he will not allow the great distance to sever his connection with the Conference.

Fr. Valentine Schaaf, O. F. M., J. C. D., finally, has been appointed Associate Professor of Canon Law at the Catholic University of America, and we know from his scholarly dissertation on "The Cloister" that his classes at the University will serve to recall the memory of another brilliant Franciscan who taught there some few years ago, Fr. Paschal Robinson.

A rising vote of thanks was extended by the Conference to all these Friars who have been upholding so nobly the Franciscan traditions of scholarship and literary craftsmanship, and the hope was expressed that many of their Brethren would pay them the sincerest compliment of imitating their splendid efforts.

The problem of compiling a list of the Incunabula preserved in the Franciscan libraries of the United States and Canada has for some time been engaging the attention of the Franciscan Educational Conference. The interest of the Friars in these early specimens of the printer's art is part of our Franciscan tradition. The members of religious Orders were the early printers, just as they were the copyists and illustrators before the invention of movable type and zincography. The Friars everywhere welcomed and fostered the art of printing. The first printing press in England was set up by Caxton in Westminster Abbey under monastic patronage. The cloister furnished both the printing house and the composing room. Although the modern printer does not invariably order his life after the manner of the cloistered Friars, he still employs in his calling a number of words which he derived from his ancestors in the craft. "Long primer" was the size and style employed by the Friars in setting up the Office of Prime, and "brevier" that used in the printing of the breviary. The "Father of the Chapel" is a term which to this day designates the doyen of the printing shop. The walks between the cases are to this day called the "aisles" or alleys. The mischievous office-boy or apprentice who played hob with things in general, as office-boys and apprentices have always done, became the imp or "devil" of mischief. All these terms speak eloquently of the connection between the Church and the art of printing.

Aside from these historical grounds there are many practical reasons that should urge the Friars to coöperate in making up a complete list of the Incunabula preserved in the various Friaries. It is gratifying to record that several librarians have been coöperating very generously with the previous efforts made in this direction. Some librarians have even been so industrious as to report all their library books printed before 1800. Hence the Conference feels encouraged to undertake for next year's (1924) Report the compiling of a list of the Incunabula (books printed before 1500) as well as Post-Incunabula (books printed from 1501-1536 inclusively).

The Conference may congratulate itself upon having secured for the undertaking the scholarly services of the Rev. John M. Lenhart, O. M. Cap. Fr. John is well known as a specialist in bibliography, and we may rest assured that with the coöperation of the Franciscan librarians of the United States

and Canada he will have ready for next year's Report a list that will be a credit to the Conference.

It is planned to reprint the list, which will fill a good-sized pamphlet, perhaps as a separate number of the "Franciscan Studies." The publication would be cordially welcomed by librarians throughout the country, and the Conference would thus render a real service to scholars generally. The universities of Germany are planning to publish in twelve volumes a census of all the Incunabula in the world, and our prospective list may contribute its mite towards the success of the gigantic undertaking.

All communications concerning this matter should be addressed to the Rev. John M. Lenhart, O. M. Cap., 220—37th St., Pittsburgh, Pa. To assist the librarians in making out their reports, Fr. John kindly submits the following information:

The following table summarizes the reports received to date:

Libraries	Incunabula	Post-Incunabula
St. Bonaventure's Sem'ry, Allegany, N. Y.	43 titles and 45 copies	None
St. Francis' Monastery, New York	27 titles and 27 copies	None
Franciscan Monastery, Quebec, Canada	12 titles and 12 copies	None
St. Antony's Monastery, St. Louis, Mo.	11 titles and 11 copies	17
Sacred Heart Monastery, Yonkers, N. Y.	4 titles and 4 copies	4
Franciscan Monastery, Quincy, Ill.	3 titles and 3 copies	3
Old Mission, Santa Barbara, California	3 titles and 3 copies	None
St. Francis' Monastery, Teutopolis, Ill.	2 titles and 2 copies	None
St. Joseph's College, Teutopolis, Ill.	1 title and 1 copy	3
Sacred Heart Monastery, Indianapolis, Ind.	1 title and 1 copy	None
Quincy College, Quincy, Ill.	1 title and 1 copy	1
Capuchin Monastery, Marathon, Wis	1 title and 1 copy	None
St. Fidelis' Capuchin Monastery, N. Y.	1 title and 1 copy	8
Capuchin Monastery, Cumberland, Md.	None	1
Capuchin Monastery, Victoria, Kansas	None	1

This makes a sum-total of 110 Incunabula (and counting two duplicates, 112 Incunabula) and 38 Post-Incunabula. No less than 50 of these Incunabula have never been listed before, and this net gain alone would justify the publication of our prospective census.

I should like to direct the attention of the respective librarians to certain features that have been overlooked in compiling the several lists. Some of the Incunabula might be copies on vellum or parchment, a feature which enhances their value considerably. A sure means for distinguishing paper from vellum is afforded by noting the absence or presence of the so-called wire-lines. When held up to the light the paper will show straight lines running some distance from each other, and these are called wire-lines. Where no wire-lines can be detected, the book is undoubtedly printed or written on vellum.

Another matter is the determination of the size of books. It is a commonplace in bibliography that small folio and quarto, or small

quarto and octavo, are often of equal dimensions so that their difference can not be decided by mere measuring. The only reliable method for distinguishing the different sizes is to observe the position of the wire-lines of the paper. When the wire-lines run vertically, the sheets have been folded once and the size is folio. When the wire-lines run horizontally, i. e., from top to bottom, the sheets have been folded twice and the size is quarto. In the smaller size of octavo the sheets have been folded thrice and the wire-lines run vertically as in folio, forming straight lines passing from left to right. The determination of the size is at times the only means for distinguishing undated early books, and since bibliography is still in its infancy with regard to the early products of the printing press, the librarian should never omit the indication of size when describing Post-Incunabula.

Other features which should likewise be mentioned invariably are type (whether gothic, italic, or common roman), number of lines and columns (whether one or two) to the page, woodcuts, rubrication (whether initial letters are filled in by hand or not), musical notes (printed or hand-written), and mathematical figures. All these features should be indicated in detail, at least when describing Post-Incunabula.

In case that some of the early books are collections of different parts or works condensed into one volume, all the separate parts should be described in detail. The foliation or pagination with Roman or Arabic numerals should also be mentioned, as well as the pages left blank or replaced (in case of mistakes) by better print.

It is an erroneous view that the early printers issued books only in large sizes. There are Incunabula printed in the small sizes of 24mo and 32mo; and Post-Incunabula, in the very small size of 64mo. These tiny books are generally overlooked by librarians when searching for Incunabula. I should, therefore, advise every librarian in search of old books to examine the small books in his library. These small-sized books were mostly prayerbooks, and from the viewpoint of devotional literature they are extremely precious.

It is to be regretted that none of the librarians reporting the Incunabula, made mention of the marks of ownership which are deeply interesting to the bibliographer. The Capuchin Monastery at Marathon, Wis., boasts a copy of the German Bible printed in 1483 which was preserved from the 15th century down to the beginning of the 19th in the library of the Canonesses of St. Agnes' Convent, Trier, Germany, as is attested by the inscriptions on the inside cover. The two volumes of the Incunabula of St. Bonaventure's "Commentary on the Sentences" which are preserved in the Capuchin Monastery of St. Fidelis, New York City, were during the 16th century in the possession of a priest in Bavaria. Similar inscriptions will be found in many other Incunabula and Post-Incunabula now preserved in the various Franciscan libraries, and should be communicated to the compiler of the census.

Librarians are likewise requested to report incomplete volumes, or fragments of Incunabula, or even single leaves. In these cases the descriptions must, of course, be very detailed so as to enable the bibliographer to identify the parts. To lighten the labor of identification it is also suggested that all measurements of printing surface be given in millimeters (mm) and not in inches.

Other helpful directions will be found in the "Census of Fifteenth Century Books Now Owned in America" (New York, 1919), which is out of print, but which may be consulted in public libraries.

Information concerning book-manuscripts (over 70 pages in extent)

preserved in the libraries will also be gratefully received. Manuscripts are, however, comparatively rare in this country. Some thirty years ago the Antiquarian Ludwig Rosenthal offered for sale the manuscript breviary used by St. Francis, and eventually sold it to the Franciscan Monastery at Munich. The American Friars should not miss the opportunity to procure other old Franciscan manuscripts that are still offered for sale by European dealers.

The Library of Congress is revising its list of manuscript collections in the public and private libraries and the historical societies of the United States, and all persons having knowledge of historical manuscripts or important collections of papers of Americans prominent in political, military and business life, or in literature and the fine arts, are requested to communicate with the Library. This list was first compiled and published in 1918 and has been of great value to historical students. The present revision is being undertaken in the hope of making the list more nearly complete.

The Conference takes this occasion to request the Librarians of all our Monasteries and educational institutions to coöperate promptly and generously with the scholarly efforts of Fr. John.

After having disposed of this business, the Friars took up the matter of deciding upon a subject for next year's Meeting. The Delegates had been asked previously to give the matter their earnest thought, and now responded by proposing several important topics for treatment. The interesting discussion ended by agreeing that a subject of interest to all Departments of the Conference, but of particular appeal to the College Department, viz., the language element in education, should be treated at our next Meeting.

The following is the program of papers and writers agreed upon for our next Meeting:

1) Language Studies in the Franciscan Order: a Historical Sketch. By the Rev. John M. Lenhart, O. M. Cap.
2) The Science of Language. By the Rev. Berthold Hartung, O. F. M.
3) The Art of Language. By the Rev. Simon J. Archambault, O. F. M.
4) The Teaching of Literature. By the Rev. Constant Klein, O. M. C.
5) Training Our Students and Especially Our Clerics for Literary Activity and Productive Scholarship. By the Rev. Gabriel McCarthy, O. M. Cap.

It was also decided that our next Meeting should again be held either immediately before or after the annual convention of the Catholic Educational Association, i. e., towards the end

of June, so that the Friars might find it just as convenient as this year to attend both gatherings.

The report of the Committee on Resolutions was presented by Fr. Ferdinand Mayer, O. M. C. After a brief discussion which called for a few additions, the Resolutions were accepted in a slightly enlarged form.

The final business was the election of officers for the ensuing year.

The following Friars were elected by ballot:
President, Fr. Thomas Plassmann, O .F. M., Allegany, N. Y.
Vice-President, Fr. Ferdinand Mayer, O.M.C., Syracuse, N. Y.
Secretary, Fr. Felix M. Kirsch, O. M. Cap., Herman, Pa.

The following Friars were chosen as members of the Executive Board of the Conference: Conventual Province of the Immaculate Conception, Fr. Ferdinand Mayer, O. M. C.; Conventual Province of St. Anthony of Padua, Fr. Cyril Kita, O. M. C.; Province of the Holy Name, Fr. Thomas Plassmann, O. F. M.; Province of the Sacred Heart, Fr. Philip Marke, O. F. M.; Province of St. John the Baptist, Fr. Rudolph Bonner, O. F. M.; Province of Santa Barbara, Fr. Joseph F. Rhode, O. F. M.; Province of the Immaculate Conception, Fr. Hugolinus Bifarini, O. F. M.; Province of the Assumption of Our Lady, Fr. Cyril Piontek, O. F. M.; Canadian Province, Fr. Simon J. Archambault, O. F. M.; Capuchin Province of St. Joseph, Fr. Theodosius Foley, O. M. Cap.; Capuchin Province of St. Augustine, Fr. Felix M. Kirsch, O. M. Cap.

Before adjourning the Friars heard part of an article written on the Conference by a European scholar who has been called not only one the foremost ecclesiastical historians of the present time but also one of the most brilliant teachers in the Catholic academic field, Very Rev. Professor Henry Schroers, of the University of Bonn. Writing in "Theologie und Glaube," Vol. XIV (1922), pp. 129ff., Professor Schroers says:

The perusal of the "Report" fills us with joyous anticipations. Meetings resulting in such solid achievements as that of the Franciscan Educational Conference are the best proof that the scientific spirit has not only been awakened but is courageously marching on. The Friars of the New World may well serve as models to those of the Old World; as a matter of fact the German lectors of the Franciscan Order have been induced by the American example to convene last fall for scholarly deliberations at the Kreuzberg Monastery in the Rhoen.

We are well aware that the needs of immortal souls and the stress and strain of the strenuous life which is characteristic of the other side of the Atlantic, compel the religious Orders to devote their energies almost exclusively to pastoral labors. But in the nature of things and by the light of experience we know also that the arduous and difficult roads they have to travel must be illumined by the torch of the sacred sciences and that this torch demands its specially qualified torch-bearers. We know that one of the well-springs from which the pioneers of salvation drink refreshment is sacred knowledge —sacred through its supernatural origin and the service rendered to the supernatural—and this well-spring is fed from the convent cells of monastic scholars.

How often does not the laborer in the vineyard of the Lord lose his way in those dense thickets of anti-Christian science which can be laid low only by the ax of orthodox doctrine! The sons of the Poverello of Assisi were endowed with a power of expansion the like of which has not been seen in the history of the Church since the days of the Apostles; and at the very time when they were spreading over the whole world to bring to a spiritually impoverished race the true Gospel, other sons of the Seraph of Love and Zeal were sitting before and upon the chairs of the University of Paris. This is genuine Franciscan Tradition!

The Chairman remarked that praise from such authority was praise indeed. He voiced the sentiments of all the Friars when he declared, "Non nobis, Domine, sed nomini tuo da gloriam!" After giving thanks to the Lord for all that He had permitted the Conference to accomplish during the five years of its existence he implored the blessing of the Father of Lights upon our efforts so that the members of the "triplex Familia S. P. N. Francisci" might always continue in coöperating so successfully for the greater glory of God and His Church, and the benefit of our Order and our Seraphic youth.

Fr. Felix M. Kirsch, O. M. Cap., Secretary.

PAPERS AND DISCUSSIONS

SCIENCE IN THE FRANCISCAN ORDER

A HISTORICAL SKETCH

Fr. John M. Lenhart, O. M. Cap.

SCIENCE in its broadest concept is synonymous with learning and systematic knowledge. But general usage has restricted its meaning to the systematized knowledge of nature and natural phenomena, thus making it a short term for natural science. Natural science taken in a very wide sense includes both physics and chemistry, and the large class of descriptive sciences together with mathematics and its allied disciplines.

Origin of Science in the Franciscan Order

Being a body of cultured men the early Franciscans were familiar with the natural sciences in so far as they were taught in the schools of the time. In this regard the early Franciscans did not differ from the early Dominicans or the members of other religious Orders.

However, St. Francis introduced into his Order a new stimulus for cultivating the study of nature — the poetical motive. Love of nature was the great passion of our Seraphic Father. He sought in all things for the traces of God's beauty and found them even in the lowest of His creatures. Conscious of our common origin he called them his brothers and sisters. His heart went out in love not only to his fellowmen, but to all the lower animals—the birds in the air, the beasts on the land, the fishes in the sea. He loved the rock and the forest, the meadow and the vineyard, the rivulet and the blue sky, fire and water and wind; and called upon them all to remain pure, to praise their Maker and be His servants. Where other men saw only fleeting beauty, St. Francis perceived by intuition the eternal links which bind the physical order to the moral order, and the eternal principles which connect the mysteries of nature with the mysteries of faith. He loved the beauty of the flower, delighted in its sweet odor, and was reminded thereby of the mystical flower on the stem of Jesse. He

preached to birds as though they were endowed with reason. He praised the industry of the bee, and held up to his disciples as models the lark and the dove. In the eighteenth year of his Penance, he composed the *Canticle of the Sun,* and thus interpreted for the medieval and the modern world the sentiment of the Old-Testament *Benedicite.* It may be noted in passing that Renan did not hesitate to proclaim St. Francis one of the great religious poets of all time, and his *Canticle of the Sun* as the greatest religious poem since the Hebrew Psalms were written. The noble poem reveals, in spite of its brevity, the whole soul of the Saint, but discloses especially his tender love for every one of God's creatures.

St. Francis passed away amid the sweet strains of his *Canticle of the Sun,* but his brethren had caught of his spirit. The generation of Friar-poets who went out from Assisi brought home to the world at large the message of the *Canticle of the Sun.* Still these poetical hymns to nature, which broaden out as time went on into mystical and apocalyptical effusions, are not products of science. The study of science in the Franciscan Order is a by-product of the study of philosophy and as such is a later development of the original ideal of St. Francis.

St. Francis was opposed to the study of all purely profane sciences in his Order, and allowed the study of theology only.[1] Towards the end of the year 1223, St. Antony of Padua opened, with the approval of the Seraphic Father, the first theological school at Bologna, and the scholastic movement spread so rapidly that twenty-five years later schools had been established in all Provinces of Italy and France.[2] Some of these theological schools had in the meantime taken up the study of philosophy and the natural sciences.

First Franciscan School of Science

It was about the year 1230 that Robert Grosseteste began in the convent of the Friars Minor at Oxford his lectures on the natural sciences and philosophy. The convent of Oxford was therefore the first Franciscan school of science, and remained throughout the thirteenth century the most famous Franciscan school for the study of the natural sciences.

1 Hilarin Felder, O. M. Cap., "Geschichte der wissenschaftlichen Studien im Franziskanerorden." Freiburg, 1904, pp. 95ff.

2 Felder, l. c., pp. 149, 153, 155.

Aristotle continued during the entire Middle Ages the great master in the natural sciences as well as in philosophy. His works were used as textbooks in the schools, were commented upon by generations of teachers, and formed the starting-point for new researches and systems. In the Franciscan Order no less than in the rest of Christian Europe, the natural sciences were inconceivable apart from Aristotelianism. However, prior to 1250 the schools at Oxford and Paris formed the only centres where the natural sciences were seriously studied along with philosophy.

But in spite of strong opposition on the part of the so-called Spiritualists the study of the natural sciences and philosophy was gradually introduced into all Franciscan schools during the latter part of the 13th century and was finally approved formally by the General Constitutions of 1292 so that henceforth these studies formed part of the official curriculum in the schools of the Friars Minor.[3]

Formal Approval of Science Teaching

Felder[4] interprets the wording of the General Constitutions of 1292 as having reference to medical studies. He contends that throughout the thirteenth century the word "physica" stands for "medicine" in all legal texts as well as in decrees of Councils and Popes: "Since the natural sciences were to form not only the most important and extensive branch of medicine, but also to put medicine upon a new and scientific basis, and really had a better claim than medicine to the denomination of Physics, the General Chapter had as early as 1292 called the natural sciences by the name of Physics; the words: *Physica legantur,* in the General Constitutions of 1292 accordingly mean 'physical sciences which are preparatory to medicine'." But this opinion of the distinguished historian is erroneous. The Provincials and Custodes who framed the Constitutions of 1292 could have in mind nothing else than Aristotle's *Physics* which had by that time been studied in the schools for more than sixty years; the "commentaria in physicam" circulating among the students were commentaries on Aristotle's *Physics,* so that "physica" had long before 1292 become a technical term for the Aristotelian natural sciences. Therefore the first official approbation of these sudies marks a mile-

3 Felder, l. c., pp. 462, 465.
4 Felder, l. c., pp. 390-394.

stone in the history of the natural sciences in the Franciscan Order.

A historical sketch of the study of the natural sciences among the Friars Minor can not overlook, as is generally done, the corresponding teaching of the schools in the different ages.

Importance of the General History of Science Teaching

Most of these systems, popular in bygone ages, may seem mere rubbish to our generation, yet they formed the mental pabulum for thousands of Friars and were, in many a case, stepping-stones in the upward march of modern science. The hypotheses of the past claim just as much respect as some of the supposed achievements of modern science which will be classed before long among the vagaries of the human mind.

TRADITIONAL TEACHING OF THE SCHOOLS

Dominicus Gundissalinus (died after 1153) is the first apostle of Aristotelianism in Europe. He is the first Latin author who in his own works availed himself of Aristotle's

Influence of Aristotle

physical writings. Yet Gundissalinus, like his successors Simon of Tournay (died after 1196) and Alain of Lille (d. 1202), used Aristotle's physical writings only sparingly, and was primarily a philosopher.

Alexander Neckam was the first Peripatetic naturalist of Latin Europe. Born at St. Albans in England in 1157, he came to France at an early age and obtained a professorship at Paris in 1180, but returning a few years later he died in 1217. In his work, "De natura rerum" (edited by Wright, London, 1863) he includes dissertations on the four elements, on astronomy, natural history, mineralogy, and optics.

Alfred Sereshel or Sarchel (died after 1227), another Englishman, added an exposition of physiology and psychology, while the Scotchman Michael Scotus (died about 1234) popularized the pseudo-Aristotelian book on physiognomy and Arabian astronomy, chemistry, and the occult sciences.

At this juncture the great Friar Minor Alexander of Hales (died 1245) entered and made the whole range of Aristotle's philosophy tributary to Catholic theology. The huge *Summa* of Alexander of Hales is the first successful effort to utilize

Aristotelian philosophy in the interests of speculative theology.[5] Alexander quotes Aristotle's physical and metaphysical books as well as the commentaries of Avicenna and Averroes, and this had never been done by any previous theologian.[6] A detailed study of the use made of Aristotle's works by Alexander of Hales is still a great desideratum, and we may hope that some future day a studious Friar may fill out this gap, the more so since the forthcoming standard edition of Alexander's *Summa* will greatly facilitate such researches.

"Whether Alexander of Hales," writes Fr. Felder, (op. cit., pp. 204-205, note 3), "has compiled regular commentaries on Aristotelian works, is still a moot point. Two works quoted in a document of the Parisian University from the year 1286 under the title: *Commentum Alexandri super librum Metheororum et Phisiognomia Aristotelis* have remained unnoticed hitherto, and they may be ascribed to Alexander of Hales or his namesake Alexander of Paris." But this conjecture of the distinguished Friar is preposterous. The two commentaries spoken of in the document are the works of the celebrated Greek philosopher Alexander of Aphrodisias (died after 211 A. D.) which had been translated into Latin and were widely used at the universities. Alexander of Hales did not write commentaries on Aristotelian books.

Science in the Oxford Friary

The systematic study of Aristotle's physical books and what was then considered natural sciences, was inaugurated in the Franciscan Order by the lectures of Robert Grosseteste in the Friary at Oxford in 1230. Grosseteste was born in 1175, became Bishop of Lincoln in 1235, and died in 1253. He was a genius in every regard, great as theologian, philosopher, scientist, and philologist. He compiled a systematic *Summa* of Aristotle's eight books of *Physics,* wrote a compendium on the globe, books on geometry, arithmetic, and chronology, and also a *Compendium of the Sciences* treating of medicine, music, optics, and politics. The *Summa philosophiae* treating of forms, colors, iris, and comets is spurious.[7]

Grosseteste reaped his highest honors at his Franciscan school, had his best scholars and friends among the Friars,

5 Felder, l. c., pp. 199ff.
6 Felder, l. c., p. 204.
7 This book has been published by L. Bauer, "Robert Grossetestes philosophische Werke z. erstenmal vollst. in kritischer Ausgabe besorgt." Muenster, 1912, in "Beitraege," IX.

and wrote a large number of his books in the Friary. He must therefore be regarded as the first Franciscan scientist.

Adam of Marsh, the fast friend of Robert of Grosseteste, was the first Friar who taught at the Franciscan School in Oxford (from about 1234 till his death on Nov. 18, 1258). Roger Bacon praises him as a great scholar and speaks highly of his attainments in the domain of the natural sciences. Unfortunately none of his works seem to have survived the ravages of the time, so that we can not give any details regarding the particular merits of this Franciscan scientist.

Roger Bacon speaks in terms of high praise of what the Oxford Friars achieved in the study of the natural sciences. The Oxford Friary is in his eyes the centre of all experimental and physical sciences, as well as of mathematics. But these early Oxford Scientists, with but one exception, have not left any works and accordingly remain mere names in the annals of the history of the inductive sciences.

Friar John Peckham (d. 1292), who taught at Oxford and Paris and later became Archbishop of Canterbury (1279-1292), is one of the few writers on optics during the thirteenth century. His work published under the title *Perspectiva communis* is, however, actually nothing else than an extract from Alhazen's (Ibn. Heitham, lived about 1100 A. D.) *Optics* which had been translated from Arabic into Latin a few years before. Nevertheless, it deserves to be mentioned as a proof of the interest taken in optics at that time. Peckham's *Optics* enjoyed a great popularity during the Middle Ages, a fact which is amply attested by its appearing in print at Milan between 1480 and 1482 and by the commentaries made to elucidate it.[8]

The death of Roger Bacon in 1294 marks the end of the polymathic school of sciences established by Grosseteste in the Franciscan Order. A new period was beginning — that of Aristotelian philosophy and physics: new researches became rarer and old opinions were rehearsed in countless variations by the commentators on Aristotelian books.

Duns Scotus (died 1308) is in the Order of Friars Minor what Albert the Great and St. Thomas Aquinas had been fifty years before in the Order of Friars Preacher: the great Master

8 "Archivum Franciscanum Historicum," V (1912), p. 771.

Scotus and the Scotists

who firmly established Aristotelian philosophy in the schools. His system may be a compromise and like all compromises may represent only a makeshift, yet it embodies more Aristotelian elements than those of his predecessors. Unfortunately Scotus was prevented by death from devoting his energy to the study of Aristotle's physical writings. The Commentaries on Aristotle's eight books of *Physics* and *Meteorology* printed under Scotus' name in his *Opera omnia* (Vols. II, III, and IV, Paris, 1891-1892) are spurious beyond any doubt.[9]

The celebrated disciple of Scotus, Francis of Meyronnes (Mayronis), who died in 1325, is the first Friar who wrote a Commentary on Aristotle's eight books of *Physics*.

He was followed by the Friars and Scotists, John Anth. Andreae (d. about 1320), John Canonicus (d. about 1320), Francis Rossi of the Marches (d. after 1344), Nicholas Bonetus (d. 1360), Peter of Aquila (d. about 1370), Philip of Florence (lived about 1313), James Binatus de Blanchiis (lived about 1343), Nicholas de Orbellis (died after 1465), and finally by William of Occam (d. 1349), the famous Nominalist.

The books of Mayronis, Andreae, Canonicus, Bonet, Orbellis, and Occam remained standard works in the schools till the middle of the 16th century and passed through many editions between the years 1475 and 1542. The Commentary of Canonicus was the first to be printed (Padua 1475) and that of Mayronis the last (Venice, 1542). The Commentaries of Francis Rossi, Peter of Aquila, Philip of Florence, and James Binatus were never published, an evident proof that they had been forgotten at the time of the invention of printing.

At a very early time the work of systematization was begun and Aristotle's numerous books on the physical sciences were condensed into methodical treatises.

Systematizing Aristotle

We mention as the earliest authors of this kind Francis Spineti of Aqua Putrida (d. about 1343) with his "Compendium conclusionum universae philosophiae sive diadema philosophorum de reconditis naturali arcanis,"[10] Gerhard Odonis (d. 1348), "De naturali philosophia," which is still unpublished; and John of Bassolis (d. about 1347), "Miscellanea philosophica et medica." In the 16th century the most popular textbook in the natural sciences written by a Friar was the "Compendium philosophiae naturalis" by Francis Titelmann (d. 1537), who originally an Observant, was a Capuchin during the last two years of his life, 1535-1537. His textbook was first published at Lyons in 1545, and was re-published within the next half century in numerous editions. The "Philosophia naturalis Joannis Duns Scoti" (Venet., 1606, 1622) of Philip Fabri, O. M. Conv. (d. 1630), marks the end of this phase of the study of the natural sciences in the Franciscan Order.

9 Ibid., III (1910), pp. 626-632; V (1912), p. 775.

10 This work has not yet been published; cf. "Archivum Franciscanum Historicum," III (1912), p. 300, note 3.

The Cursus Philosophiae

With the year 1600 there begins a new period in the history of natural sciences in the Order. The separate commentaries and small compendia are mostly displaced by voluminous *Cursus philosophiae* which systematically treat in the section named "Physica particularis" the whole range of the natural sciences, including at times even mathematics.

Aug. Gothut ("Gymnasium speculativ.," Paris, 1605) and Vincent Ciorla de Scamno ("Disputationes Philosophicae," Romae, 1640-1649, and Neapol., 1652) led the way among the Scotists, and were followed by Michael Francus ("Disputat. Philos.," Naples, 1650); John Poncius, d. 1660 ("Philosophiae cursus," Romae, 1642; Paris, 1648; Lugd., 1672); Alexander Rubeus de Lugo, O. M. Conv., d. after 1664 ("Philos. cursus," Bonon., 1656-1660); Angelus a S. Francisco (Richard Mason), d. 1678 ("Philos. cursus," Duaci, 1656); Bartholomaeus Mastrius de Meldula, O. M. Conv., (d. 1673), and Bonav. Belluti, O. M. Conv., (d. 1676) wrote conjointly "Disputationes in Physicam Aristotelis" (Romae, 1637, Venet., 1644, etc.), "Disput. in libros de generat., de coelo, mundo et meteoris" (Venetiis, 1640), which were collected in their "Cursus Philosophicus" (Venet., 1678, 1688, 1708, 1727); Bonaventura Baron, d. 1696, the Irish Friar, ("Cursus Philosophicus," Coloniae, 1664); Livius Rabesanus de Montursio ("Philos. cursus" 6 partes, Venet., 1664-1674; Paris, 1668); Gulielmus van Sichem, d. 1691 ("Cursus philosophicus," Antwerp., 1666 and Antw., 1678); Thomas Llamazares ("Curs. philosophic.," Lugd., 1670); Felix Rotundus de Monte Leone ("Cursus philosophic.," Patav., 1672-1673, Patav., 1689); Joseph Lealus ("Paediae Scoticae juxta Aristotelis principia," Venet., 1673); Angelus de Sonneno ("De triplici philosophia Aristotelis," Romae, 1672-1673); Claudius Frassen, d. 1711 ("Cursus philosophiae," Paris, 1668; Tolosae, 1686; Romae, 1726; Venet., 1767); Amandus Hermann, d. 1700 ("Curs. philosophiae," Sulzbach, 1676); John Gabr. Boyvin ("Philosophia Scoti," Paris, 1681; Bonon., 1690; Venet., 1701; Venet., 1734); Bernard Sannig ("Curs. philosophic.," Prag., 1684-1685); John Anth. Ambrosinus ("Enchiridion philosophic.," Neapol., 1689-1693); Peter a S. Catharina and Thomas a S. Joseph, Ord. Strict. Observ. ("Cursus philosophic.," Venet., 1697; Venet., 1714; Venet., 1732); Sebast. Dupasquier ("Summa philosophiae," Patav., 1705; Patav., 1718; Patav., 1732); John a Trinitate and John a Nativitate ("Curs. philosophiae," Salmant., 1712; Vallisolet., 1713); Peter Arcedeckne ("Curs. philosophic.," Pragae, 1732); Crescent Krisper, d. 1749 ("Philosophia scholae Scotisticae," Augsb. 1728 and 1735); Marin Panger, d. 1732 and Kilian Kazenberger, d. 1750 ("Philosophia Aristotelica," Ingolst., 1739); Alip. Locherer ("Clypeus philos.," Krems, 1740), Anton Melgaco ("Scotus Aristotelicus," Lisbona, 1747); Jos. Ant. Ferrari de Modoetia, O. M. Conv., ("Philos. Peripatetica," Venet., 1746-1747; Venet., 1767); Franc. Jacquier ("Institutiones philosophicae," Venet., 1764); Vincent Gonzalez a Penna ("Curs. philosophiae," Salmant., 1765-1767); Cyrill Zorn ("Encyclopaedia philos.," Aug. Vind., 1774); finally Carol. Joseph a S. Floriano ("Scoti philosophia nunc primum recentiorum placitis accommodata," Mediol., 1771-1782).

Among the followers of St. Bonaventure we mention Marc. Ant. Galitius, O. M. Cap., d. 1665 ("Cursus philosophic.," Romae, 1634-1636); Martinus de Torrecilla (d. 1709), O. M. Cap. ("Curs. philosoph.," Matrit.,

1667-1671); Bartholomaeus Barberius, O. M. Cap. ("Curs. philos.," Lugd., 1677); Hyacinth. Olpensis, O. M. Cap. ("Cursus philos.," Barcinone, 1691); Gervas. Brunk of Breisach, O. M. Cap., d. 1711 ("Curs. philos.," Colon., 1699); and Franc. a Villaplanda, O. M. Cap. ("Curs. philosophiae," Matrit., 1777-1778).

Special subjects of the natural sciences were discussed in numerous works as "Vestigationes peripateticae" (Patav., 1639) by Matthew Ferchi (d. 1666), "Paralipomena philosophica" (Antw., 1652) by Franc. Conventriensis, "Meteorologia" (Romae, 1644) by Franc. Resta a Talleacotio, "Theatrum Meteorologicum" (Romae, 1660) by Franc. Macedo (d. 1681) and in regular commentaries on Aristotle's works on the natural sciences.

Subjects for Historical Research

These numerous works which represent the traditional teaching of the natural sciences in the Franciscan Order have never yet been studied by historians of modern science and yet they contain the most precious material for tracing the various stages of the introduction of modern science into the schools. How the results of exact science were first rejected by the Aristotelians, then coördinated with Aristotle's teachings, and finally adopted as ascertained truths is a story which has not yet been told in the history of modern science. The historians are looking only for new researches, and the Scholastic philosophers are not interested in the natural sciences of past ages. Let us hope that a studious Friar, well versed both in Aristotelian and modern science, may give us an extensive history of the traditional teaching at least from the year 1485 that witnessed the first printed edtion of the *Cursus philosophiae seu compendium mathematicum, physicum et metaphysicum* of Nicholas de Orbellis (Bononiæ, 1485; Basil., 1494; Basil., 1503), to the year 1782 when the first *Philosophia recentiorum placitis accommodata* by Car. Jos. a S. Floriano was published.

Science Teaching in the 19th and 20th Centuries

During the 19th century the natural sciences have been rigorously eliminated from the textbooks of philosophy, and the Friars used the books current in the schools of the time. No Friar has within the last hundred years taken pains to compose a suitable textbook for our students. The English Capuchin Lawrence McCarthy published three mathematical textbooks from 1886-1897, and this represents the sum total of what, as far as I know, the Friars produced during that long period of time.

The 20th century opened with a movement to include again the natural sciences, at least their general principles, under the

scope of philosophy and to restore the encyclopedic character of that branch of knowledge. The "philosophy" (or first principles) of astronomy, botany, and other sciences was written by competent men and the attempt was made to incorporate these results into the Latin textbooks of Scholastic philosophy. However, the Friars have up to the present time stood aloof to a very great extent. Consequently the study of the natural sciences has a purely cultural value in their curriculum, and is not yet raised to the higher dignity of forming a branch of the great synthesis of all human sciences.

NEW RESEARCHES

Robert Grosseteste (d. 1253) was the founder of the Franciscan school at Oxford and was therefore the first scholar to render an enduring service to Franciscan science. He also made a study of all problems of nature as far as was possible with the meagre equipment of the time. He wrote about the atmosphere, sound, light, movement, heat, perspective, astronomy, geometry and arithmetic, medicine, and music. "No man," writes Roger Bacon,[11] "knew the sciences so well as Robert Bishop of Lincoln." Many works of Grosseteste are still unpublished, and a detailed study of his achievements as a scientist has never been attempted. Louis Bauer has written on Grosseteste's theories about light: *Lichtmetaphysik Grossetestes* in the *Abhandlungen,* Hertling gewidmet (Freiburg, 1913).

Roger Bacon (d. 1294) was the first Friar to achieve immortal fame in the annals of science. He had mastered the whole range of contemporary science, was versed in the science of the ancients, and made original researches in mathematics, mechanics, optics, chemistry, medicine, and the descriptive natural sciences. In mathematics and physics he was far superior to his only rival, Albert the Great. Roger Bacon was the first scholar to give the correct computation of the focus in a concave mirror, to describe a method of making parabolic burning-reflectors, to detect the errors of the Julian Calendar, to systematize the discoveries of Geber in the domains of chemistry in numerous works;[12] and his writings probably led

11 "Opus Tertium;" cf. Felder, l. c., pp. 263-264.
12 Collected in Roger Bacon, "Thesaurus chymicus." Francof., 1603-1620.

up to the contemporary invention of spectacles. Where he presents the results of his predecessors, one feels instinctively that he has mastered the problems completely; there is a solidity and keenness of penetration about his style which are sadly wanting in his predecessors.

"Roger Bacon possessed," says J. C. Poggendorff,[13] "an inventive genius and a wealth of original ideas which would have led him in more advanced times and under more favorable conditions to many an important discovery and invention. As things were, his ideas remained mere projects. He speaks among other things of automobiles, flying machines, lifting-engines, telescopes—all of which evinces his talent for applied mechanics. However, his vivid imagination and sanguine expectation often led him to speak of his projects, as though he realized them." "We may blame him," says Sig. Guenther,[14] "for speaking more of the method of experimenting than applying the method in experiments, but in those days it was an achievement merely to point to the right road." In the domain of the descriptive sciences Roger Bacon was no less a master. He made original studies in mineralogy, botany, zoölogy, and comparative anatomy and physiology — everywhere testing the theories of former scientists by his own observations. Roger Bacon had studied all mathematical works of his age and tried to solve almost all mathematical problems in his own way, thereby proving his mastery in theoretical and applied mathematics. He was the first to apply mathematics to physics by a reliable method and on an extensive scale.[15] Though the number of his original discoveries is not large, he anticipated by several centuries the scientific methods of modern times and must be classed among the foremost scientists of all ages.

Roger Bacon was the master of a school of scientists at Oxford. One of these scientists, Thomas of Bungay, Friar Minor and Professor at Oxford University (died about 1300) was, like Roger Bacon, a great student of mathematics and physics. Owing to his experiments in physics and his work dealing with these sciences entitled *Natural Magic,* he shared his master's fate of being looked upon as a magician.

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13 "Geschichte der Physik." Leipzig, 1879, p. 34.
14 "Geschichte der Naturwissenschaften." Leipzig, 1909, p. 88.
15 Felder, l. c., pp. 418-419.

His work, *De Magia naturali,* is still unpublished, and hence we can not say much about this Franciscan scientist.[16]

Germany boasts of Berthold Schwarz, the reputed inventor of gunpowder. While it is certain that he was not the first to make this discovery, it is commonly admitted now that the invention of firearms is due to him. This Friar is variously placed into different ages, but this invention was most probably made about the year 1313.[17]

In Spain the Friar John Giles Zamora, the confidant of King Alphonse X. (1252-1284), shed lustre upon the Franciscan Order. His studies of the natural sciences, his linguistic attainments and his sane views on debated questions of theology have merited for him the title of a second Roger Bacon.[18]

The celebrated physicist, astronomer and astrologer Guido Bonatti of Forli (d. 1296), a Friar Minor, drew scholars to his professorial chair from all parts of Europe. He wrote *Theoria Planetarum* (printed Venet., 1506) and *Liber astronomicus.*[19]

In 1320 a professor at the University of Paris whose name is not known, had taught the immobility of the sun and Francis of Meyronnes incorporated this doctrine into his *Commentary* on Peter Lombard (l. II, dist. 14, q. 5) written in the same year. Accordingly Friar Francis of Meyronnes (d. 1325) has the unique distinction of having first spread by writing the Copernican system of the rotation of the earth.[20]

Bernard of Verdun who lived toward the end of the thirteenth century, also cultivated the study of astronomy. He had read Bacon's writings and wrote a *Tractatus super Astrologiam* (manuscript in National Library of Paris, cod. lat. 7333 and 7334), in which he refutes the objections raised by Bacon against the Ptolomaic system.[21] He was apparently the first of the Latins to adopt a method of figuration in the system of eccentrics and epicycles tracing all celestial motions acknow-

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16 "Kirchenlexikon," II, 1887, 1508; "Grey Friars." Oxford, 1892, p. 153.

17 Poggendorff, l. c., pp. 86-90; Max Heimbucher, "Die Orden und Kongregationen der katholischen Kirche," Vol. II. Paderborn, 1907, p. 467.

18 Heribert Holzapfel, O. F. M., "Handbuch der Geschichte des Franziskanerordens." Freiburg, 1909, p. 293.

19 Printed Aug. Vind., 1491; Basil., 1510; cf. Wadding, V, 1733, "Arch. Fran. Hist.," II, p. 464.

20 Pierre Duhem in the "Archivum Franciscanum Historicum," VI (1913), pp. 23-25.

21 "Histoire litter. de la France," XXI. Paris, 1847, pp. 317-320; "Arch. Fran. Hist.," VI (1913), p. 565.

ledged by Ptolemy back to the rotations of solid orbs accurately fitted into one another. This representation which refuted most of the objections raised against Ptolomaic astronomy, became very popular in the course of time.[22]

Revolution in Science

Between the years 1277 and 1377 all the essential principles of Aristotle's *Physics* were undermined, and the basic principles of modern science formulated. This revolution was first the work of Oxford Franciscans (Richard of Middleton, d. 1300, Duns Scotus, d. 1308, and William of Occam, d. 1349), and later of masters in the Schools of Paris who were heirs to the tradition inaugurated by these Franciscan theologians. Richard of Middleton first overthrew the Aristotelian teaching that an empty space is an impossibility and thus laid the foundation of that branch of mechanical science known as dynamics. Again, Richard of Middleton and Duns Scotus, whilst continuing to admit that the earth was absolutely stationary and the heavens moved with a rotary diurnal motion, began to formulate hypotheses to the effect that these bodies were affected by other motions. Not quite twenty years later Francis of Meyronnes of the School of Paris taught the earth's motion, not any more as a possibility, but as a reality. Furthermore, Richard of Middleton, William of Ware (d. after 1300) John of Bassols (d. about 1347), and William of Occam taught that God could create other worlds similar to ours, a doctrine which required that the Aristotelian theory of gravity and natural space be changed radically. Finally, William of Occam was responsible for the overthrow of Aristotelian dynamics. By means of spirited argumentation, William of Occam demonstrated the absurdity of the Peripatetic theory of the motion of projectiles and established an essential identity between the constitutive matter of celestial and sublunary bodies.[23]

John of Monte Casale wrote in 1346 a treatise on motion and other problems of natural science, which is still unpublished.[24]

Raimundus Lullus (d. 1315), though not a Friar, but only a Tertiary, can not be overlooked here. About the year 1300

22 "Catholic Encyclopedia," XII. New York, 1911, p. 49.
23 Duhem, ibid., pp. 50-52.
24 "Archivum Franciscanum Historicum," I (1908), p. 116; II (1909), p. 632; III (1910), p. 300.

he perfected a method of reckoning the tonnage of ships which had been known in principle by Greek seafarers and was later called "Marteloio."[25] He was the first to give a detailed description how to make mirrors by backing glass with lead. However, he enjoys a greater reputation as a chemist or alchemist. Most of the numerous works bearing his name must be attributed to a namesake, Raimundus Catalanus, a converted Jew.

Alchemy

Alchemy seems to have received particular attention among the Friars from the very first. The search for the "quinta essentia" or elixir of life, and the desire to effect the transmutation of base metals into silver and gold, must have engrossed their attention. However, most of the works assigned to Friars are literary forgeries or of doubtful authorship. Brother Elias of Cortona (d. 1253), second general of the Order, is credited at least with four alchemistical works *(Liber Saturnini, Liber alchimicalis,* etc.).[26] Bonaventure of Iseo (lived before 1300) wrote *Liber Compostellae* dealing with alchemy and medicine, and *Tractatus metallorum* or alchemy.[27] Richard of Middleton (d. 1300) is the reputed author of a *Speculum alchymiae.* Raymond Gaufredi (d. 1310), the thirteenth general of the Order, compiled an explanation of Roger Bacon's alchemistical work *Verbum abbreviatum (Arch. Franc. Hist,* III (1910), p. 553). To Duns Scotus is wrongly ascribed a *Quaestio an ars alchimica aurum generare possit.*[28] Later alchemists are Paul of Caureanto and Joh. Richardi de Branchiis (about 1494).[29]

But the most famous of these Friars dabbling in alchemy was John of Roquetaillade (Rupescissa), who died about 1362. His experiments in distilling led to the discovery of what he called *quinta essentia,* and which he commended as a panacea in his works: *De consideratione quintae essentiae* (printed in Basel, 1561) and *De extractione quintae essentiae.* In the *Libellus de conficiendo vero lapide philosophico* (printed at Strassburg, 1659) and *Liber lucis* (printed at Leyden, 1598),

25 Guenther, "Geschichte der Naturwissenschaften." I, p. 80.

26 "Archivum Franciscanum Historicum," III (1910), p. 354; V (1912), pp. 129-130.

27 Ibid., I (1908), pp. 116-117; II (1909), p. 655; III (1910), p. 556.

28 Ibid., III (1910), p. 554.

29 Ibid., pp. 355, 558.

he recommends a remedy he had discovered for all the physical ills that flesh is heir to.[30]

Notwithstanding some false ideas which prompted the researches of the alchemists, many advances were made in descriptive chemistry, metallurgy, distillation, and pharmacology. Unfortunately, however, these early alchemists have never received any attention from historians. Roger Bacon and Raimundus Lullus are the only Friars whose alchemistic achievements have been at all noticed.[31]

Mathematics

Roger Bacon informs us that his teachers at Oxford had no rivals in mathematics and particularly in geometry. In fact, the latter subject was taught in no other school at the time.[32] The greatest mathematician of the Franciscan Order and of Europe in the Middle Ages is Lucas Pacioli (Paciuolo), who was born at Borgo San Sepolcro about 1450 and died soon after 1509. His scientific writings became the basis for the works of the sixteenth century mathematicians, including even the geniuses Cardan and Tartaglia. In his first work, *Summa de Arithmetica, Geometria, Proportione et Proportionalita* (printed at Venice in 1494), a large work of six hundred folio pages, he applied algebra to geometry, made known the art of book-keeping by double entry, and treated of the theory of probability. The *Divina Proportione delle Matematiche* (Venice, 1509, reedited in part with notes by Winterberg, Vienna 1897) treats among other things about the "sectio aurea," the inscription of polyhedrons in polyhedrons, and the use of letters to indicate numerical quantities. In 1509 he published at Venice the *Trattato dei cinque Corpi regolari e dipendenti do essi* and *Euclidis Elementa.*[33]

Fra Giovanni Giocondo (d. 1515), the famous architect, was likewise a great mathematician. He published in 1511 at Venice an edition of Vitruvius' *De architectura,* and illustrated it with charts and figures. Moreover, he produced some monographs on points of applied architecture.[34]

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30 "Catholic Encyclopedia," Vol. VIII. New York, 1910, p. 477; "Kirchenlexikon," Vol. VI, 1889, 1761f.

31 Felder, l. c., pp. 399-401.

32 Ibid., p. 417.

33 "Catholic Encyclopedia," Vol. XI, New York, 1917, p. 383.

34 Ibid., Vol. VI, New York, 1909, pp. 563ff; "Archiv. Fran. Hist.," II (1909), p. 389; VI (1913), p. 356.

The Making of Didactic Apparatus

On account of the ingenious mechanical helps employed as aids to teaching we must mention here the works of the great satyrist Thomas Murner (d. 1537): *Chartiludium logicae* (Cracov., 1507; Argentor., 1518; mnemotechnics teaching Aristotelian logics by going through a game of chess), *Ludus Studentum* (Francof., 1511), and *Chartiludium Institute summarie* (Argent., 1518), which latter teach prosody and jurisprudence according to the same method. The most popular system of mnemotechnics up to the eighteenth century was the *Ars Magna* of Raimundus Lullus which was first printed at Venice in 1480 and passed through seventeen editions prior to 1536. Among the Friars the foremost exponent of the Lullian art was Bernard of Lavinheta *(Introductorium,* Lugd., ca. 1514; Lullii *Ars magna interpretat.,* Lugd., 1517, *Opera Artis Lullii explicationem tradens* edit. J. H. Alstedio, Colon., 1612). The *Epistola de nutrienda memoria* of Friar Dominicus de Carpanis (printed at Naples in 1476) can not be called a mnemotechnical work.

Friar Frederic Krafft of Nuremberg (beginning of the 16th cent.) was remarkable for his mathematical attainments which he put to the best of use in constructing an astrolabium serviceable for all degrees of altitude of the pole and in making two celestial globes, one representing the movements of the three planets and the other those of Venus and Mercury (Minges, *Franzisk. in Bayern,* Muenchen, 1896, p. 62).

The Making of Musical Instruments

The two Friars Konrad Rottenburger and Leonhard Marcae (latter half of 15th cent.) were famous organ-builders. The former built before 1475 the largest organ now in the Minster at Ulm, in 1475 the organ in the Stift at Bamberg, and finally the magnificent organ with manual and pedal in the church of the Friars Minor at Nuremberg. The latter enlarged the organ in St. Lawrence's church at Nuremberg (Minges, l. c., p. 61). Even more famous was Urban of Venice who built organs for the Cathedrals of Treviso and Venice (about 1425). The lutes and violas made by Dardelli of Mantua (about 1500) were very much in demand. [35]

Music was regarded in the Middle Ages as a branch of mathematics, and the theory of music or the arithmetical syst-

35 Holzapfel, l. c., pp. 297ff.

em regulating this art was taught in the schools. St. Louis of Toulouse (d. 1297) is the first Friar who wrote a treatise on the theory of music, entitled *Sententia in musica sonora,* i. e., polyphonic music, which has been published lately.[36] In the 16th century Bonaventure of Brescia wrote *Regula musicae planae,* a very popular treatise on plain chant (printed at Brescia 1500, Venice 1524, 1539, ca. 1550 and without imprint ca. 1500). Peter Canuzzi and Francis of Bruges are two other Friars who wrote on the theory of music about the year 1500.

The branches of descriptive natural science were not neglected by the Friars during the Middle Ages. In this domain Bartholomaeus Anglicus (d. after 1250) ranks first with his encyclopedia of all sciences, entitled *De proprietatibus rerum.* This book was widely popular for nearly four hundred years, and no other textbook in natural science could compare in popularity with this digest of the English Friar. From 1474 till 1536 no less than thirty-two editions appeared in print (17 Latin, 9 French, 3 English, 2 Spanish, and 1 Dutch); the last edition was published at Frankfurt in 1601. The whole range of natural science is treated in this work, but in such a manner that natural history receives most attention. Bartholomaeus Anglicus is the greatest naturalist of the Middle Ages. The sections on natural history contain a wealth of personal observations, and the part dealing with geography is of permanent value.[37]

Discoveries and Explorations

The Franciscan missionaries scattered over the globe contributed no small part to the history of medieval discoveries and descriptions of new countries. John de Piano di Carpine (d. 1252) travelled through Germany, Bohemia, Poland, Southern Russia and Asia to the Grand Khan at Karakorum and wrote a report which describes the political conditions, ethnography, history, and geography of the Tartar lands. Friar Benedict of Poland, one of his companions, added a similar description of the Slav countries. Both these works, however, are surpassed by the writings of William Rubruck (d. after 1256) whose report Peschel pronounces to be "the geographical mas-

36 "Archivum Franciscanum Historicum," II (1909), pp. 378-383.

37 Felder, l. c., pp. 248-254, 395-397; Langlois, "Connaissance de la nature au Moyen-Age." Paris, 1911, pp. 114-179; Thomas Plassmann, O. F. M., in the "Archiv. Fran. Hist.," XII (1911).

terpiece of the Middle Ages." He was the first Christian geographer to give reliable information concerning the position of China and the character of its inhabitants. The glowing pictures he drew of the wealth of Asia first attracted the attention of the seafaring Venetians and Genoese to the East. His book describing his journeys was for centuries the sole source of knowledge for the geographical and cartographical representations of Asia.

Odoric of Pordenone (d. 1331) is in the extent of his travels the greatest traveller of the Middle Ages. In April, 1318, he started from Padua and went through Armenia, Persia, India to China. On his return journey he went overland through northern China, Tibet, Persia and Armenia, reaching home in 1330. The account of his travels was widely spread in the Middle Ages and was the first source available for studying the manners and customs of the peoples of the Far East. Menentillus of Spoleto, a Dominican, who was the first geographer to prove in 1310 the peninsular shape of India, made use of a work of a Franciscan for his geographical and oceanographical description of India. This work which is now lost, was most probably written by John of Monte Corvino (d. 1328). John of Marignolli (d. after 1360), the last Franciscan Friar who travelled to China in the Middle Ages, left Italy in April 1339 and passed through Turkey, Persia, India and the South Sea to China where he arrived in 1342. On his return journey he took the same route and arrived in Europe in 1353. John of Marignolli became one of the greatest travellers in Asia, and has left an account of his itinerary which is much studied to-day by geographers of the Far East; he demolished many a geographical myth and furnished a vast amount of new information.[38]

Literature of the Holy Land

During the past seven centuries Palestine has been a country of deep interest to the Friars. The numerous *Itineraries,* or guide-books, compiled by Friars besides giving descriptions of the Sacred Places and exact directions for the route, contain a great deal of information about the country and people of Palestine and the neighboring lands of Asia Minor, Egypt, Arabia, Persia, and even India. The *Passagia in terram*

38 Hartig in the "Catholic Encyclopedia," Vol. VI. New York, 1909, p. 448.

sanctam are important for the history of oceanography and climatology, and the *Regimina,* or dietary rules to be observed during the passage, interest greatly the historian of medicine. However, this extensive literature has never been studied from the viewpoint of science and here a big gap remains to be filled out.

Friar Nicholas of Poggibonsi travelled to Palestine in 1345 and gave an account of his voyage in *Libro d'Oltramare.*[39] Alexander Ariosto (d. 1484) wrote in 1463 the *Topographia Terrae Promissae.*[40] Paul Walther of Guglingen's *Itinerarium in terram sanctam* (1481-1483) was edited by Sollweck (Tuebingen 1892). Francis Suriano (d. after 1515) wrote *Trattato di Terra Santa e dell'Oriente* which was published by G. Golubovich, O. F. M., at Milan in 1901.

Physical and Mathematical Geography

The scientific investigations of the Friars had also a great share in the progress of physical and mathematical geography. Columbus was emboldened to carry out his great project on the strength of Roger Bacon's statement that India could be reached by a westerly voyage, an assertion based on mathematical computation. Even before Ptolemy's *Geography* had been rediscovered, Roger Bacon attempted to sketch a map, determining mathematically the positions of places. Peschel pronounces this to have been "the greatest achievement of the Scholastics." Cardinal Pierre d'Ailly (d. 1425) whose encyclopedia *Imago Mundi* was a favorite book of Columbus, had drawn largely on Roger Bacon's writings for this work.[41]

MODERN SCIENTISTS AND NATURALISTS

In modern times the Friars continued their researches in science; they helped to advance the knowledge of various countries and races and contributed to the development of the theory of the physical and mathematical sciences.

Among the inventors of astronomical instruments the Capuchin Anthony Marie Schyrl has become quite famous. Born in 1597 at Reutte, in Tirol, and accordingly often sur-

39 Edited by Bacchi della Lega at Bologna in 1882; "Archiv. Fran. Hist.," IV (1911), p. 362.

40 First published by Marcellin da Civezza, O. F. M., in "Storie delle Missioni Francesc.," Rome, 1861, reprinted Rome, 1863, and in 1909 in the "Rev. de l'Orient Latin," XII, Paris, pp. 1-67; "Archiv. Fran. Hist.," V (1912), p. 377.

41 Hartig, l. c., p. 450.

Scientific Instruments and Mechanical Inventions

named de Rheita, he died in 1660. He is the inventor of the so-called terrestrial telescope. In 1608 Hans Lippershey invented the astronomical telescope which, however, was unfit for observing sublunary things. Kepler adjusted a third lense in front of the eyepiece and thus made it serviceable for observation of subastral matter. Schyrl invented a combination of four convex lenses which show the object in its natural upright position. We may regard this terrestrial telescope either as a double astronomical telescope or as consisting of one object-glass and three convex eye-glasses. It is superior to Kepler's telescope with three lenses and is still much used, whereas Kepler's instrument has been forgotten. Schyrl made known his invention in his great work *Oculus Enochii et Eliae seu Radius sidereomysticus* (Antw., 1645). In this work Schyrl first coined the terms "ocular" and "objective" still in use, and drew a moon-chart (Poggendorff, *Gesch. d. Physik*, Leipz., 1879, p. 196). Schyrl was less fortunate in the defense of his peculiar geocentric system, which is in the main that of Tycho Brahe. For the rest his large work of 630 folio pages contains a complete system of astronomy, so that he occupies a conspicuous place among the astronomers of the seventeenth century. It is curious that Schyrl claims to have seen several moons around Jupiter, Saturn and Mars. He described these discoveries in his work: *Novem stellae circa Jovem visae, circa Saturnum sex, circa Martem nonnullae a P. Ant. Rheita detectae*, Lovanii, 1643.[42] Later astronomers treated these discoveries as illusions.[43]

The Capuchin Cherubin Le Gentil of Orleans (d. about 1680) was a famous physicist, astronomer and mathematician. In 1671 he published a large work on dioptrics: *La dioptrique oculaire*, a folio with 60 copper-plates (reprinted in Paris, 1675). In his work: *De visione perfecta* (Paris, 1678) he describes his invention of the binocular microscope which was far superior to the older models of Galileo and Divini. His third large work, *L'effect de la force de la contiguité des corps* (Paris, 1679) treats among other things about a telegraph invented by him.

Valerian Baron of Magni, who was born at Milan in 1587

42 Poggendorff, l. c., p. 197.
43 Ibid., p. 637.

and died at Salzburg in 1661, is the third Capuchin famous in the annals of inventions. In 1643 Torricelli had invented the barometer at Florence. Four years later Valerian published at Warsaw a work: *Demonstratio ocularis* (reprinted at Bonon., 1648, and Venet., 1649) in which he describes the barometer that he had designed without knowing of the invention of the famous Italian. The startingpoint of Valerian's invention were the suction pumps of Galileo. He concluded that the rise of mercury which is thirteen times heavier than water must be correspondingly thirteen times lighter.[44]

The Capuchin Francis Marie Jablier (or de la Rallier), who was born at Paris in 1634 and died at Marais in 1714, is the inventor of the photometer. He described his invention in the book: *Nouvelle découverte sur la lumiére pour la mesurer et en copter les Dégrès,* printed at Paris in 1700. He called his invention a photometer, and this name is still in use. A second instrument for the same purpose was constructed by him, and the firm of Fougerais placed the photometers on the market.[45]

Emmanuel of Viviers (d. 1738), a Capuchin, was a noted astronomer and mathematician. He was a corresponding member of the French Academy at Paris, and constructed telescopes and microscopes which were widely used in those days. He published numerous astronomical calendars, a *Calendrier perpétuel* (Toulouse, 1728), and a *Cadran astronomique* (Toulouse, 1737) showing the position of the principal cities in relation to the fixed stars.[46]

Chrysologus André of Gy (d. 1808), a Capuchin, is famous as astronomer and geographer. He designed two planispheres (1778-1779) with an *Abrégé d'astronomie* as guide for the use of them (1778), and these were highly extolled by the savants. Moreover, he made a map of the world and wrote an explanation of it (both printed at Paris in 1774 and 1778), and made four other special maps. In 1805 he published a description of his improvements on the barometer. His last work *Theorie de la surface de la terre* (1806) is one of the first works on geology and was praised highly by Cuvier.[47]

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44 Kamshoff, "Bunte Bilder." Warnsdorf, 1905, pp. 37-39; "Bibl. Script. Capuc." Venet., 1747, p. 242.
45 "Etudes Franciscaines," Paris, X (1903), pp. 655-658.
46 "Bibl. Script. Capuc.," p. 80.
47 "Etudes Franciscaines," Paris, V (1901), p. 399-412; IX (1903), pp. 83-84.

The Franciscan Peter Singer (d. 1882) gained international fame by his invention of an orchestrion, which he called "Pansymphonikon," and which is still preserved in the Franciscan Monastery at Salzburg.

Among the inventors we find the Capuchin Julian of Mamers who invented one of the first acetylene generators. The first model of a fountain pen was made by the Capuchin Candide of Magland. In 1906 there was a successful test in Rome of the apparatus invented by the Capuchin Angelo Fiorini, Bishop of Pontremoli, for averting railroad collisions. The apparatus is so constructed as to indicate automatically whether there is an obstruction on the track, by signalling in due time to the nearest station and to the train crew. After many experiments the invention received the unanimous approval of expert mechanics and was adopted by the Italian government. The inventor has described the apparatus in his pamphlet, *Sistema di blocco ferroviario automatico,* Rome, 1906.

Pure Science

In the domain of pure science there are several illustrious names. Hilarius Altobello, O. M. Conv. (d. about 1630), published a star-map, *Tabulae Regiae Maceratae,* and his knowledge of mathematics and astronomy was highly extolled by Kepler.[48] The Capuchin Melito Llobet of Perpigan (d. 1755), member of the Academies of Science of Paris, Toulouse, and Montpellier, wrote several works in defense of the Gregorian Calendar *(Les Epactes grégoriennes justifiés,* Toulouse, 1738; *Gregoriana Correctio vindicata,* Colon., 1743; *Apologia Correctionis Gregorianae,* Colon., 1745; *Apologia iterata Correct. Gregor.,* Colon., 1754) besides a work setting forth by an ingenious method of mathematical calculi how to find the best samples for mosaics. This last work, however, remained unpublished owing to the exorbitant cost of printing.[49] The Franciscan Polycarpus Poncelet of Verdun created a sensation during the second half of the 18th century by the researches he made in organic chemistry.[50] The Capuchin Lawrence Fantoni of Milan (d. 1801) lived almost fifty years on the mountain pass of St. Godhard and published his meteorological observations for the years 1782 and 1784-1792 (in *Effemeride di Mannheim*

48 Holzapfel, l. c., p. 608.
49 Apollinaire de Valence, O. M. Cap., "Histoire des Capucins," Vol. II. Toulouse, 1897, pp. 489-500.
50 Holzapfel, l. c., p. 577.

and *Briefe aus der Schweiz* edit. by Andrea). The Fathers Onuphrius, Pius, and Seraphin assisted him in his work. Goethe who twice received the hospitality of the Capuchins on the St. Godhard (1779 and 1797), speaks highly of Lawrence of Milan.[51]

Horology

The making of clocks and dials was a favorite pursuit among the Friars prior to the 18th century. They also wrote many treatises on horology and gnomonics; ex. gr., *Trattato di fare gli Orologi* (Venet., 1617) by Theophilus Brunus of Verona, O. M. Cap. (d. 1638), *Retta linea gnomonica* (Forli, 1667) by Jos. Maria a Cento, O. M. Cap. (d. 1682); *Thaumalemma* (Venet., 1589) by Cherubinus Sandolinus, O. M. Cap.

Mnemonics

Mnemonics continued to be a favorite study of the Friars. Among those eminent in this field we mention Hieronymus Marafioti, O. F. Min. *(Ars memoriae,* Francof., 1602; Argent., 1603; tradotta di Latino, Venez., 1605), and the expositors of Raimundus Lullus' *Ars Magna,* the Capuchins Juvenal de Ruffinis of Nonsberg (died 1713, *Synopsis artis magnae sciendi,* Salzb., 1689; German transl. by Franz. Haggenmiller, O. M. Cap.: *Der goldene Zirkel,* Augsb., 1904) and Louis de Flandes *(not* Flanders, d. about 1750, *El antigo academico,* Madrid, 1742-1747).

Great as may be these achievements of the Friars in the domain of pure and applied science, they are, however, eclipsed by their work in the field of the descriptive natural sciences.

Discoveries and Explorations

Their achievements in the discovery and description of new lands form a bright chapter in the history of modern geography and allied sciences. As early as 1500 we find the Friars in India and America. Starting from Quito, Ecuador, Franciscans discovered the source of the Amazon in 1633, the River Napo in 1647, and the Pará River in 1650. The Recollects Hennepin, dela Ribourde, and Mambré penetrated to the Great Lakes and Niagara Falls in 1680 and the following years, and also navigated the Mississippi. Friar Gabriel Segard, a Recollect, sojourned among the Hurons from 1624 to 1626 and gave us the first description of that tribe; and Friar Christian Le

51 Valdemire Bonari, "Cappuccini della Provinc. Milanese," Vol. II. Crema, 1898, pp. 526ff.

Clercq, likewise a Recollect (d. about 1695), who labored among the Micmacs (1675-1687) wrote a description of the Indians and the country of the Maritime Provinces of Canada (transl. from the French by W. F. Ganong: *New Relation of Gaspesia,* Toronto, 1910).

The Capuchins Cavazzi (1654), Carli (1666), Merolla (1682) and Zucchelli (1698) accomplished remarkable results in the exploration of the Congo region. Even as late as the year 1862 the geographer Petermann made use of their writings to construct a map of that region. The Capuchins spent thirty years in Tibet (1707-1745) and sixty years in Nepal (1706-1769), and both Tibet and Nepal have ever since remained "forbidden countries." Joseph Count of Bernini, O. M. Cap. (d. 1761), wrote the first description of Nepal (published in part in the *Asiatic Researches,* II, Calcutta, 1790). In the boundary dispute between British Guayana and Venezuela the maps drawn by the Capuchins were the most important documents in settling this quarrel.[52]

Holy Land Literature

The descriptions of the Holy Land multiplied to a great extent. We instance the following: *Descriptio terrae sanctae et urbis Jerusalem* by Anselmus Polonus, O. F. M., (Cracov., 1514), *Vermerkung der heilig. Stet* by Nichol. Wankel, O. F. M. (Nuremb., 1517), *Descripcion de la Terra Santa* by Antonio de Aranda, O. F. M. (Alcalá, 1531), *Elucidatio terrae sanctae* by Francis Quaresmius (Antverp., 1639, Venet., 1880), the standard work, *Trattato delle piante ed immagini dei sacri edifizi in Jerusalemme* by Bernardino Amico, O. F. M. (d. 1590, Rome, 1609; Florence, 1620). Of recent date are the guide-books of Lievin de Hamme (d. 1898) and Barnabas Meistermann.

Natural History

Natural history was cultivated by many Friars in modern times. The celebrated Humanist Joannes Camers, O. M.Conv. (d. 1546), compiled a summary of Plinius' *Natural History (Index Plinianus,* Viennae Austr., 1514; Venet., 1525) and wrote annotations to Solinus' *Polyhistoria* (Viennae Austr., 1520), thereby popularizing the natural history of the ancients. Antonio Brandimarte, O. M. Conv., published *Plinio Seniore illustrato nella*

52 Strickland, "Documents and Maps." Rome, 1896.

descrizione del Piceno (Roma, 1815), an edition of Pliny with plates. Electus Zwinger (d. 1690) is famous for his: *Blumenbuch des Hl. Landes* (Muenchen, 1661) with many pictures and charts designed by himself. Marianus Velloso (d. 1811), the "American Linné," is one of the foremost authorities on the flora of Brazil. The Conventual John Bonavita Blank (d. 1827), Professor of natural history at the University of Wuerzburg, bequeathed his large collection to that university. Joseph Giraldi, missionary in North-Shensi, has been sending to Europe since 1890 a great number of new specimens of plants. Julius Gremblich (d. 1905), Professor at the Franciscan Gymnasium of Hall, was known as a great botanist. The celebrated botanist Charles Plumier (d. 1704) was no Friar Minor, as Bihl states erroneously,[53] but a Minim.[54]

The Capuchin Tiburtius Prost of Jussey (d. 1804) was a mineralogist who collected a large number of minerals and fossils which now form the nucleus of the museum of Besancon. Prudentius Vauchoz of Faucogney (d. 1792) wrote on forestry and agriculture.[55]

Cartography

The Conventual Vincent Marie Coronelli (d. 1718) is the greatest cartographer among the Friars, and one of the ablest and most productive cartographers and globe-makers of the world. His universal atlas *Atlante Veneto* in 13 folio volumes was printed at Venice 1689-1700. The two largest globes made by him (diameter 13 feet) are in the National Library, Paris; smaller ones are at Venice, Genoa, Bologna.[56] Because of his excellent work he received from the Emperor the title: "Cosmographus publicus." Coronelli is likewise famous for his picturesque representations of ecclesiastical costumes *(Ordini Cavallereschi,* published about 1702 with 210 plates) and his *Epitome cosmografica per fabbrica delle sfere, globi, planisferi, astrolabi e tavole geografiche* (Venez., 1683), a work treating of the making of globes and other astronomical instruments with many interesting details and 32 plates.

Among the many writers on the theory of music we single out Angelo da Piccitono *(Fior angelico di musica,* Vineg., 1547); Illuminato Aiguino da Brescia *(La illuminata de tutti*

53 "Catholic Encyclopedia," VI, p. 296.
54 Ibid., XII, p. 169.
55 Morey, "Capucins en Franche-Comte," pp. 225-228.
56 Cf. Fiorini, "Coronelli ed i suoi globi," 1892.

i tuoni, Vineg., 1562); Silverio Picerli da Rieti *(Specchio di musica,* Napoli, 1630-1631); Bernh. Scheyrer *(Musica choralis,* Muenchen, 1663, in German); Andrea da Modano *(Canto harmonico,* Modano, 1690), one of the best works on plain chant; Zaccaria Tevo *(Il musico testore,* Venez., 1706); Ant. Martin y Coll *(Arte de canto llano,* Madrid, 1714 and 1719); Pablo Nassare *(Escuela musica,* 2 vols. fol., Zaragoza, 1723-1724); Fabric. Tettamanzi *(Metodo per apprendere il canto fermo,* Milano, 1726);[57] and Stanislas Mattei *(Practica d'accompagnamento,* Bologna, 1824). Mattei was a Conventual, but all the others were Friars Minor.

Medicine

The Friars Minor acted as physicians from the very beginning of the Order, since they regarded it as their duty to nurse the sick, especially the lepers.[58] However, their contributions to the scientific study of medicine seem to have been very moderate during the Middle Ages. Pharmaceutics was cultivated by the Observants Francis Sirena *(L'arte dello spetiale,* Pavia, 1679) and Onuphrius Friggi *(Ricette Galenistiche,* Pavia, 1692). The Capuchin Cesare Magati (d. 1647) is famous for his reform in surgery.[59]

Subjects for Further Research Work

The foregoing is but a meagre sketch of what the Friars have done for science. An adequate history of the activity of Friars in these branches can not be attempted at the present time. We have raised problems and pointed out gaps which may keep studious Friars busy for many a year. Natural science is embodied not only in special works but scattered throughout the theological and philosophical literature. Salimbene (d. 1288) describes many natural phenomena in his famous Chronicle. The preachers delivered symbolical sermons taking their material from science; in a sermon of John Capistran, as quoted in the *Arch. Franc. Hist.,* VI (1913), pp. 83-90, twelve properties of light are adduced to symbolize twelve virtues. The theologians and philosophers discussed the laws of nature in their Scholastic works. Even romances on the style of Jules Verne's, like the *Somma dei*

57 Eitner, "Quellenlexikon der Musik." Leipzig, 1900, I, pp. 154ff.; VI., p. 350; VII., p. 148; IX., p. 15, p. 386.
58 Felder, l. c., pp. 275ff., 394, 401ff.
59 Egisto Magni, "Cesare Magati, O. M. Cap., e la sua riforma nella chirurgia." Bologna, 1919.

quattro Mondo by Friar Pacifico Stivivi of Rimini written in 1581,[60] should not be lightly passed by, since they reveal to us the limitations of science at a particular period.

DISCUSSION

Lessons from History

FR. CUTHBERT:—It was a real surprise for me to hear that so many of our Brethren in days gone by delved in the sciences, and that so much of what is called modern must be traced back, at least in great part, to the ingenuity and laborious research of the Friars of Old.

The paper of Fr. John is well written and is a credit to his scholarship. It must have cost him a great deal of time and labor to compile the impressive list of Friar-scientists.

The paper will be an inspiration to all who may chance to read the Report of our Meeting. To all readers, whether within or without the Order, it will be a revelation showing that the Friars of the olden days were very active indeed in the pursuit of the sciences; but to the readers within the Order the paper will moreover be an incentive to renew our efforts to emulate or at least to uphold the splendid traditions of our saintly and scientific Brethren of the past.

Franciscans as Pioneers in Medieval Science

FR. SIMON:—I should like to stress the fact that the Franciscan Scientists of the Middle Ages were not only the most remarkable scientists of the time, but were also the leaders in the movement that assured the sciences a definite place in the course of study. The Dominicans were, indeed, great students of theology, but they ruled drastically against the study of the sciences in the Provincial Chapter of Barcelona in 1299: "Volumus et ordinamus ut fratres in hujusmodi scientiis non studeant, nec de medicina, vel de secularium causis, unde possit ordini scandalum generari, se ullatenus intermittant. Quod si contra fecerint, sint privati libris hujusmodi facultatum" (Douais, "Acta Capitulorum Provincialium O. P.," Toulouse, 1894, p. 648, No. 14).

Many Franciscans were, of course, of the same way of thinking; even the majority were. But the English Franciscans were an exception, and from the beginning paid a great deal of attention to the sciences. Roger Bacon justly regarded the experimental sciences as the foundation of medical science. It was through his personal efforts that the study of the sciences was finally approved by the sons of St. Francis in the General Constitutions of 1292, and gradually also by the sons of St. Dominic.

Roger Bacon

FR. GRATIAN:—H. G. Wells enumerates Roger Bacon among the six greatest men in history, and says of him that he had "such a vision of what was needed in the world for education and fruitful knowledge as no other man had." But Wells speaks unfairly of the "night of the 13th century" in which Bacon shone "like a star." As a matter of fact the 13th century has rightly been called the greatest of the centuries, and it was distinguished for such great men as Dante, St. Thomas Aquinas, St.

60 "Archivum Franciscanum Historicum," V (1912), pp. 148-149.

Bonaventure, Alexander of Hales, Duns Scotus, Albert the Great, and Vincent of Beauvais. Among them Roger Bacon deserves, indeed, a high rank. The 13th century was largely devoted, it is true, to the intensive study of philosophy and theology, whereas the interests of Friar Roger were mainly scientific, experimental, and linguistic. And since the modern period is one of scientific achievements, considerable interest has been taken in this Friar and his work. Furthermore, because he was silenced by his religious superiors, many modern scientists, who resent ecclesiastical intervention, and who are unacquainted with medieval thought, have hailed him as a modern by nature and a medieval by fate. As a consequence, his works have been reprinted and studied by many who otherwise might find little interest in him.

Both Catholics and non-Catholics admit that he was a man of great intellectual ability. Humboldt, for instance, calls him the greatest man of his century. It may be said of him that he laid down the principles of modern science and of the experimental method.

Roger Bacon was born about the year 1214 near Ilchester in Somersetshire, or according to another tradition in Gloucestershire. From his own account of money expended in research studies, and other casual references, it would seem that his family was one of some wealth and standing. Of his early life little is known. At Oxford his professors very probably were the Dominican Richard Fitzacre, Robert Grosseteste, who in 1224, before his elevation to the see of Lincoln was "rector" of the Franciscan school at the University, and Adam Marsh, who was the first of a long line of Franciscan professors. Bacon always held Lord Robert of Lincoln and Friar Adam in the highest esteem.

The influence of Grosseteste over Roger's mind must have been quite extraordinary. Grosseteste himself was a Greek scholar and a scientist. He wrote much about physics, light, and optics. He also composed opuscula on philosophy. No doubt, his influence with its strong mathematical and physical bent, dominated the early training of Roger, who afterwards followed and superseded him in his daring scientific speculations.

The thirteenth century is known in a special way because of the sway that Scholasticism held over the leading minds of that time. It can not be doubted that Scholasticism produced some master minds. Philosophy and theology were enriched by works that even to-day call forth our admiration. Even the enemies of Scholasticism must concede that this period was rich in men who can easily compare with the greatest of modern times. The more unbiased historians study the men and works of this period, the more evident it becomes that the Middle Ages were by no means dark ages.

But as in every movement we may distinguish a period of prosperity and a period of decline, so with Scholasticism too we may say that it reached its zenith in the great Scholastics of the thirteenth century. After them came men who were more given to speculation, often idle and barren, than to the search of well-established truth. Instead of sound logic and solid argument they employed sophism and subtlety. They gave scant recognition to facts and gave more weight to the authority of a book or a master. This was what Roger Bacon could not brook. He would have men study nature and its phenomena. He attacked those who slavishly adhered to the older methods, with a bitterness and intemperance of language, that was uncalled for, and to which much of the harshness with which he was treated was

due. He recognized the good in Scholasticism. But he aimed at improving upon it. He would enlarge its scope and widen its horizon. Outworn formulas should not serve as the sole demonstration of truth. He desired that a greater place in the domain of human knowledge be given to languages, history, applied mathematics, and the experimental study of nature and its laws.

Roger Bacon was not the man who taught one thing and practised another. He was a master of Latin, the universal language of the schools, writing it with a certain ease, naturalness, and elegance. His knowledge of Greek was such as to enable him to read Aristotle in the original. He also knew Hebrew and Arabic — his knowledge of Arabic seems to have been extraordinary—and he lashed theologians mercilessly, demanding of them how they could discover the real meaning of Holy Writ, if they ignored the Biblical languages. In this contention Roger was undoubtedly right and if he had been less violent or more persuasive, he would have accomplished much more than he did. As it is, theologians and Scripture scholars of a much later date have profited by his suggestions.

But the field in which Roger Bacon especially distinguished himself was that of the sciences. His was essentially a scientific mind. For him, the two foundations of knowledge and science were observation and reason. Yet his scientific observation, his relentless logic never caused him to waver in his acceptance of the dogmas of his faith. Notwithstanding his troubles with his superiors and his disagreements with some of the greatest men of his time, he always remained a staunch son of the Church. The three works that contain his scientific and doctrinal principles are the "Opus Majus," the "Opus Minus," and the "Opus Tertium." These works were addressed to Pope Clement IV., who was his protector and friend.

In the "Opus Majus" Roger Bacon does not follow the usual Scholastic method of that period. He does not tread the beaten path but follows his own bent. This work is a long persuasive letter on the reform of ecclesiastical studies, by one who had reform in his blood. Sketches of innumerable subjects are given in passing and the whole is written in such a pleasing style that many students find Bacon more interesting than Albert, Thomas, Alexander, or Duns Scotus. In this work, moreover, he complained that experimental science, physics, chemistry, and those other branches in which Bacon himself had specialized, were being neglected. None can doubt the sincerity of his plea, nor his love for the sciences to which he had devoted many laborious years of research and study. His "Opus Minus" and "Opus Tertium" are unfortunately left in a truncated form.

Bacon had an unusual gift for utilizing his scientific knowledge. He was above all an experimentalist endowed with a keen, practical desire to apply his knowledge to life and practice. If he had only confined himself to his science, or if in pleading its cause he had adopted less combative methods, he would most certainly have been greeted by Albert, Thomas, and his colleagues in research-work as an invaluable ally. In science Bacon was far ahead of his time. Some of his contemporaries seem to have thought him inspired by the devil. As it was, he unnecessarily made enemies for himself by his bluntness, by trespassing in the fields of speculative science and theology, and by his contempt for the leaders of Scholasticism.

Roger Bacon was not the victim of the theological narrow-mindedness of two of his own Superiors General, Jerome of Ascoli and St. Bonaventure. By his bitter controversial tone and his occasional errors Roger Bacon was a danger not only to himself, but to the

whole Order. Because of a heretical book published by one member of the Order a general prohibition was passed in 1260 by the Franciscans against the publication of books by members of their Order, unless these books were censored and, if necessary, revised by the proper authorities. The works of the English Friar came under the general law. The censure was not primarily aimed at him.

No person of sound judgment will think of blaming his superiors. They aimed at guarding the faith and the laws of charity. They were not enemies of progress in science or experimental knowledge. No, they tried to curb Roger's intemperate zeal. They may have been unduly severe in the measures taken against the author of the "Opus Majus." But when we consider that Roger Bacon wrote a great deal, that he occupied himself with almost every science, physics, chemistry, astronomy, language and mathematics, that he even caught the first dim vision of the great modern triumphs of the flying machine, the diving bell, the steam engine, suspension bridges and high explosives, then we must admit that he was not so hampered in his investigations as certain biased historians would have us believe. The Church which he always loved, has long since adopted all that is best in his plan of studies. He died about 1294 and was buried in the Franciscan church at Oxford.

Roger Bacon Celebration at Oxford

FR. WILLIAM:—It is pleasant to recall, in connection with Fr. Gratian's remarks, some of the features of the Celebration held at Oxford University on June 10, 1914, to commemorate the seven hundredth anniversary of the birth of Roger Bacon, one of the greatest of her sons. The following account was published in the "America," Vol. XI, p. 251, and was written by a Delegate (presumably Rev. Paschal Robinson, O. F. M.) to the Oxford Celebration. It is noteworthy that Monsignor Ratti of the Vatican Library, now Pope Pius XI., is mentioned among the Delegates who were "most conspicuous," and that he made an important address on the occasion.

For the ceremony there had gathered a distinguished company of scarlet-robed doctors, a number of Franciscan Friars in their brown garb, and several eminent scholars from abroad, amongst whom Monsignor Ratti of the Vatican Library in his prelatial robes, le Comte d'Haussonville in the dress of a member of the French Academy, and Professor Francois Picaret, the Delegate of the University of Paris in brilliant yellow, were, perhaps, the most conspicuous.

The principal event of the day was the unveiling of a statue of Roger Bacon in the University Museum by Sir Archibald Geikie, former President of the Royal Society, and its acceptance on behalf of the University by the Chancellor, Earl Curzon of Kedleston. The statue, which is the work of Mr. Hope Pinker, is a full length figure in white marble. It shows Bacon in his Franciscan habit, astrolabe in hand, gazing with cheerful and unflinching mien into the unknown. In unveiling the statue Sir Archibald Geikie paid an eloquent tribute to the memory of the Oxford Friar, recalling how "this eminent philosopher devoted his strenuous and checkered life to widen the boundaries of knowledge in every branch of intellectual effort and to make this increase of knowledge subservient to the advancement of mankind in virtue and religion." Roger Bacon, he said, "was one of the great forerunners in the development of the new or experimental

philosophy which some four centuries later arose into quickened activity under the inspiration of his illustrious namesake, Francis Bacon."

Lord Curzon, in a graceful speech accepting the custody of the statue, described the ceremony as a tardy reparation of a long neglect, the filling of a notable gap in the commemoration of a long line of distinguished men whom Oxford had produced. "Roger Bacon was," he said, "one of the greatest men of genius Oxford had ever known. The sciences of which he was to some extent master included theology, medicine, philology, mathematics, optics, chemistry, alchemy —though he mentioned that with some suspicion—moral and political philosophy, and experimental science of which he was the acknowledged founder and parent. He foreshadowed, moreover, if he did not actually foresee, some of the most remarkable appliances and inventions of modern days: the steamship, the railway, the telescope, the magnifying-glass, gunpowder, mesmerism, the aeroplane, and the submarine." Bacon was in reality, he concluded, one of the most unusual geniuses that England, or the world, has ever produced.

After Lord Curzon's speech addresses were presented by Fr. David Fleming, O. F. M., on behalf of the Order of Friars Minor, which he had come specially from Rome to represent, and by Professor James Ward, the Delegate from the University of Cambridge. The Public Orator, Mr. A. D. Godley, brought the proceedings to a close by delivering a Latin oration. The Delegates and other guests were afterwards entertained at luncheon by the Warden and Fellows of Merton, the College which inherited so much of Roger Bacon's glory. To Bodley's Librarian, Mr. Madan, was entrusted the toast, "In memoriam Rogeri Bacon," while Monsignor Ratti, of the Vatican Library, made the chief response to the toast of "The Delegates," which was proposed by the Chancellor, Lord Curzon. Monsignor Ratti recalled the help that Pope Clement IV. gave to Roger Bacon, and his advice to remain in Oxford in spite of the fact that he was under surveillance—advice which, if not followed, might have ended in the loss of all of Bacon's works.

Among the other Delegates present were: Professor Eugene Smith, from Columbia University; Father Paschal Robinson, O. F. M., from the Catholic University of America; Father Cuthbert, O. M. Cap., Rector of St. Anselm's House, Oxford; and Father Felix, O. M. Cap., Professor at Queen's College, Cork, who represented the National University of Ireland. The others present at the luncheon included Sir William Osler, Sir Oliver Lodge, Colonel Hime, Mr. Cloudesley Brereton, Sir Arthur Evans, Professor Turner, Professor Odling, and Professor Love.

Most of the Delegates attended the Romanes Lecture by Professor Sir J. J. Thompson at the Sheldonian Theatre, and afterwards inspected an exhibition of manuscripts, etc., relating to Roger Bacon at the Bodleian Library. A garden party in the famous grounds of Wadham College brought the splendid Roger Bacon Celebration to a close. In connection with the commemoration a volume of essays on Roger Bacon by various writers was issued by the Clarendon Press. Among the contributors is His Eminence Cardinal Gasquet, who appropriately writes on "Roger Bacon and the Latin Vulgate." It is hoped that to-day's proceedings may lead to the foundation of a Bacon Society, and may hasten the publication of the "opera omnia" of the Oxford Friar.

Science and the Devotional Temper

FR. CONRADIN: — The attitude of Roger Bacon towards the sciences appeared to many of his contemporaries and to not a few historians as destructive of the devotional temper. But this is an erroneous view. On this head I shall quote a telling passage from "The Romanticism of St. Francis" by Father Cuthbert, O. M. Cap.: "The immediate relationship between experimental science and the devotional temper of mind exhibited in St. Francis, may not be at once apparent; and in these days men are apt to regard the experimental scientist as temperamentally antagonistic to the theologian. As a matter of fact, however, the study of natural phenomena would seem to lie very close to the mystical temperament. It is in the facts of life that the true mystic seeks his knowlede, and to him phenomena are more eloquent than dialecticism. Adam Marsh, one of the most notable and pious of the early Franciscan Schoolmen, seems to have considered a study of physical phenomena together with the text of Scripture and the Holy Fathers as of more value than dialectical speculation in the study of theology."

A Protestant Authority on Explorations of the Friars

FR. MICHAEL:—It may be interesting to supplement Fr. John's account of the Friars' explorations by quoting from "Mount Everest," the new book just brought out by the Protestant Sven Hedin, the famous Swedish author and explorer. In this book Hedin gives credit to Catholic missionaries for the first explorations in Tibet and for the discovery of the peak now known as Mount Everest. He also points out several errors that have crept into the book "Mount Everest, the Reconnaissance 1921," by the English Colonel C. K. Howard-Bury which gives the history of the Mount Everest expedition of 1921-22. Col. Howard-Bury's book attracted attention from those interested in scientific knowledge and exploration not equaled since the publication of Stanley's book on his African explorations.

Referring to the English explorer's statement in his account of the journey to Tingri, that the people of that part of the country had never seen a European before, Hedin remarks, "he might just have mentioned the many Jesuit and Capuchin Fathers who repeatedly made this journey to and fro as long as two hundred years ago."

Hedin recalls how, in 1738, the Capuchin Orazio della Penna started from Rome with a party of eleven Friars. They reached Lhasa in 1741 and an account of their journey, on which they passed through Tingri and Schikar, was written by another Capuchin Fra Cassiano Belligati. As to the discovery of Mount Everest, Hedin writes:

"It was absolutely incorrect to say that Mount Everest was the discovery of the English Colonel Everest, who, in 1858, was the leader of a surveying party sent out from India, and from whom the mountain received its name. It is not my intention to injure the honor of the English topographer as a discoverer or to deprive him of it. But I can not help bringing truth from the obscurity of oblivion to light, by pointing out that Mount Everest, with only slight inaccuracies, is found under its true Tibetan name 'Tschomo-Lungma' on maps made from native materials by French Jesuits in Peking in the year 1717. These maps were later engraved in Paris and published in 1733."

In Sven Hedin's book a special chapter "Jesuits and Capuchins in the Region of Mount Everest" is devoted to a historical account of the journeys to the Himalaya and Tibetan highlands by Catholic missionaries as early as the seventeenth and eighteenth centuries. Referring to the British expedition of 1921, he writes:

Mount Everest Discovered by Catholic Missionaries

"Since, in London, people have attributed to this expedition such great importance for all mankind, it is but fair to remember the men who wandered the same way 260 and 200 years ago, not, it is true, to make geographical discoveries and much less to climb as high as possible on the mountains, but with the pious intention of preaching Christianity to the Tibetans."

With possible irony he refers to the statement of Sir Francis Younghusband, President of the British Royal Geographical Society, which aided in the 1921 expedition. In his introduction to Col. Howard-Bury's book, Sir Francis wrote:

"From the very beginning, we decided that the chief purpose of the expedition was to ascend the mountain and that everything else should be subordinate to the lofty aim of reaching the summit."

Hedin suggests that it might have been an exhibition of greater wisdom and foresight to emphasize the object of scientific and historical research in an important part of southern Tibet, and to have included the sportsmanlike exploit of ascending the mountain in second place. He adds that the sporting instinct of achievement was not what animated the Catholic Friars of the seventeenth and eighteenth centuries, that they were urged on by the love of Christ. He praises the written accounts of these journeys left by some of the early missionaries, descriptions of the country, the mode of life and manners of the people, means of travel and communication, customs and usages and the native religion.

"Others," he writes, "undertook journeys which can be compared in daring only with that of Marco Polo, and which were repeated by other Europeans only centuries later."

Hedin recalls how the two Jesuits Grueber and Albert D'Orville left Pekin in 1661 and made their way through Tibet visiting at Lhasa. They carried scientific instruments with them. Accounts of their trip, probably the first European expedition to Tibet, have been preserved in the book by Athanasius Kirchner, "China Illustrata."

In 1703 Pope Clement XI. sent a missionary band of six Capuchins to Tibet. They arrived there safely in 1707 and were later re-inforced by other missionaries. In 1745 they were driven out by the Chinese who were then masters of Lhasa. Soon after the arrival of the Capuchins, two Jesuits, Ippolito Desideri and Manuel Freyre reached the town of Dalai Lama. Father Desideri's account of their journey is preserved. It was found two decades ago and published in 1904 by the Geographical Society in Rome. Hedin refers to this account in a complimentary manner.

Capuchins in Tibet

The Capuchin Orazio della Penna in his famous "Alphabetum Tibetanum" also gives an account of his experiences and the results of his exploration in Tibet. He is entitled to the honor of having been the first to devote himself to the scientific study of the Tibetan language. Besides the books already mentioned, the accounts of Tibetan journeys written by the Capuchins Tranquillo de Apecchio and Beligatti are worthy of mention.

Sven Hedin writes of the latter:

"Beligatti as well as Desideri is a master of the art of depicting travels. In one respect he differs from the travellers of our own time; he rarely speaks of himself. When he journeyed to Lhasa through the valley of Bhutiakosi, across the Thang-la, he experienced, no doubt, many other adventures as well as the mountain sickness, but he kept them all to himself. They did not interest him. It was the knowledge of new countries and new men, their culture, their customs, and above all, their religious ideas and festivals, which Beligatti wished to preserve for the Western world. With keen eyes he observed everything and furnishes us a description of his travels, so exact and reliable that innumerable travellers of our own days might be happy if they had been able to fill their own volumes with material equally valuable. One who has travelled himself and who once had an opportunity to verify the accounts of the early Jesuits and Capuchins takes off his hat and willingly accords them admiration."

FR. THEODOSIUS:—Fr. John's paper leaves little to be supplemented as a summary of the great scientists of the Franciscan Order. The Conference appreciates the painstaking efforts of Fr. John and owes him a debt of gratitude for this valuable contribution to the history of the Order.

Tertiary Scientists

However, would it not be well to add a few names illustrious in science from the Third Order? This was suggested to the Author of the paper, who responded with his usual alacrity, and I beg leave to embody his answer here. Fr. John writes:

"Regarding the Tertiary Scientists I must say that historians are rather silent. I mentioned in my paper only one, Raymond Lullus, who is practically regarded as belonging to the First Order. About other Tertiariy scientists I am not well informed, and hence I did not mention any at all. I shall, however, add the little I know.

"The poet Dante Allighieri (d. 1321) was a Tertiary. In his principal work, 'The Divine Comedy,' he travels under the guidance of Vergil through the upper and nether worlds, and hence takes occasion to discuss problems of mathematical and physical geography. In the 'Convito' we find many similar discussions of mathematical and physical geography as well as physics. The treatise 'De Aqua et Terra,' written about 1304, has been ascribed to Dante generally, although some late scholars dispute Dante's authorship. The matter is not yet settled so that we may safely attribute the work to Dante. In a genial way and with great scientific insight it refutes the old absurdity, repeated in a thousand variations during the Middle Ages, that earth and water are two eccentric spherical bodies (Sig. Guenther, 'Geschichte der Naturwissenschaften,' Leipzig, 1909, Vol. I., p. 84).

"The poet Francesco Petrarca (d. 1374) was a Tertiary. In his ascent of Mont Ventoux, undertaken without any practical reason, he manifests a scientific purpose and evinces a sense for the study of nature which was rare at that time (Guenther, l. c., p. 79).

"Cristopher Columbus (d. 1506) was a Tertiary. He gave us in his 'Letters' the first description of America. He knew how to draw correct conclusions from the spherical form of the earth, and this was in his day a great achievement. This knowledge guided him in his discovery of America. In his description of America he evinces a keen interest in natural phenomena. He states with precision the

problems of climatic changes; he characterizes correctly the West Indies as being a remnant of a disrupted continent, and proved the declination of the magnet in the compass. His merits are not obscured by the fact that prior to his researches compasses had been known during the 15th century which had registered this declination (Guenther, l. c., p. 96).

"Louis Galvani (d. 1798) was received into the Third Order on May 26, 1779, by the Observants at Bologna and made his profession there on June 10, 1780 (Hilar. Paris., 'Liber tertii Ordinis,' Geneva, 1888, p. 148).

"Allessandro Count Volta (d. 1827) and Galileo Galilei (d. 1642) were also members of the Third Order."

Thus far Father John. We thank him for having blazed this trail for future enterprising Friars who have the taste, leisure, and equipment at hand to penetrate into the hazy labyrinths of the history of Tertiary scientists. We are sure their search will be amply rewarded and their efforts will be appreciated by all those interested in the Third Order. A further list of brilliant Tertiary names may be found in Father Hilarion Duerk's "Report of the First National Third Order Convention," pp. 575ff.

Science and Religion

FR. FELIX: — Fr. John's paper is a valuable object-lesson for studying the relation between science and religion. On this subject both scientists and theologians have engaged in hot controversy. But the diatribes of certain scientists against theology, and the anathemas of individual theologians against science seem rather absurd to the Catholic scholar who knows that truth can not be contrary to truth, and that science can therefore never contradict religion. It is true, there have been eminent scientists who believed that science and religion must ever be at war. Huxley wrote in his autobiographical sketch of 1894: "I have subordinated any reasonable or unreasonable ambition for scientific fame I may have permitted myself to entertain, to other ends: to the untiring opposition to that ecclesiastical spirit, that clericalism, which in England, as everywhere else and to whatever denomination it may belong, is the deadly enemy of science."

But the contradiction between science and religion is only apparent, and can be traced to a misunderstanding of the points at issue. "Though faith and science can never be in contradiction," says Orestes A. Brownson, "yet much that passes for faith may be in contradiction with science, and much that passes for science may be in contradiction with faith. This contradiction, indeed, affects neither what is really faith nor what is really science, but in minds not sufficiently instructed to draw sharply, on the one hand, the line between what is faith and what is only theological opinion, and, on the other, between what is science and what is only the opinion or conjecture of scientific men, it has the inevitable effect of creating, on the one side, a prejudice against science and, on the other, a prejudice against faith."

There would never be even a semblance of contradicton if each of the two departments of knowledge would confine itself to its own proper field. According to Newman, theology is the philosophy of the supernatural world, and science the philosophy of the natural world, and hence "theology and science, whether in their respective ideas, or again in their own actual fields, on the whole, are incommunicable, incapable of collision, and needing, at most, to be connected, never

to be reconciled." It has been said that St. Thomas made an alliance, not with Plato, but with Aristotle because Aristotle, unlike Plato, confined himself to human science, and therefore was secured from coming into collision with divine.

Whenever a scientific discovery is alleged to be opposed to faith, it is well to keep in mind the rule of Brownson: "Take all the facts on which the naturalists support their hypotheses, they establish nothing against faith. The facts really established either favor faith or are perfectly compatible with it; and if any are alleged that seem to militate against it, they are either not proved to be facts, or their true character is not fully ascertained, and no conclusion from them can be taken as truly scientific. . . . The sciences deal with facts and causes of the secondary order; and it is very certain that one may determine the quality of an acorn as food for swine without considering the first cause of the oak that bore it."

We may, then, rest assured that there can be no contrariety between the declarations of religion and the results of scientific inquiry. Ecclesiastical history shows that science has nothing to fear from the authority of the Church. The Church has always encouraged full freedom for the pursuit of scientific truth. The enemies of religion are fond of pointing their finger at the Middle Ages as having been the time when the Church held the human mind in bondage. But what are the historical facts? Let Newman give us the facts (Christianity and Scientific Investigation in "The Idea of a University"):

"Time went on; a new state of things, intellectual and social, came in; the Church was girt with temporal power; the preachers of St. Dominic were in the ascendant: now at length we may ask with curious interest, did the Church alter her ancient rule of action, and proscibe intellectual activity? Just the contrary; this is the very age of universities; it is the classical period of the Schoolmen; it is the splendid and palmary instance of the wise policy and large liberality of the Church, as regards philosophical inquiry.

"If there ever was a time when the intellect went wild, and had a licentious revel, it was at the date I speak of. When was there ever a more curious, more meddling, bolder, keener, more penetrating, more rationalistic exercise of the reason than at that time? What class of questions did that subtle, metaphysical spirit not scrutinize? What premiss was allowed without examination? What principle was not traced to its first origin, and exhibited in its most naked shape? What whole was not analyzed? What complex idea was not elaborately traced out, and, as it were, finely painted for the contemplation of the mind, till it was spread out in all its minutest portions as perfectly and delicately as a frog's foot shows under the intense scrutiny of the microscope?

"Well, I repeat, here was something which came somewhat nearer to theology than physical research comes; Aristotle was a somewhat more serious foe then, beyond all mistake, than Francis Bacon has been since. Did the Church take a high hand with philosophy then? No, not though that philosophy was metaphysical. It was a time when she had temporal power, and could have exterminated the spirit of inquiry with fire and sword; but she determined to put it down by 'argument,' she said: 'Two can play at that, and my argument is the better.' She sent her controversialists into the philosophical arena. It was the Dominican and Franciscan Doctors, the greatest of them being St. Thomas, who in those medieval universities fought the battle of revelation with the weapons of heathenism. It was no matter

whose the weapon was; truth was truth all the world over. With the jawbone of an ass, with the skeleton philosophy of pagan Greece, did the Samson of the schools put to flight his thousand Philistines."

Keeping in mind this traditional policy of the Church the individual theologian, too, should be generous in his attitude towards science. His attitude should be that of the many Franciscans who have been eminent in science, or of other churchmen who were scientists such as: Copernicus; Basil Valentine, founder of modern chemistry; Linacre, scholar, physician and priest; Father Kircher, scientist, orientalist, collector; Bishop Stensen, anatomist and father of geology; Abbe Hauy, father of crystallography; Abbot Mendel, authority in biology; Albert the Great, philosopher, theologian, scientist; John XXI., philosopher, physician, pope; Guy de Chauliac, father of modern surgery; Regiomontanus, astronomer and bishop; and so on.

The theologian should therefore regard science as an ally in his search for truth. He should realize that the more a man is fitted intellectually and scientifically for the work which his vocation entails, the fuller a man he will be and the more apt to exert his moral and religious sense. To the scientific investigator the theologian may quote the statement of the great English scientist, William Thomson: "Do not be afraid of bold explorations in the realm of science. If you think strongly enough, you will be forced by science to the belief in God, which is the foundation of all religion." To the scientific agnostic he may quote Fabre's paradoxical profession of faith: "I do not believe in God, for I see Him in all things and everywhere."

In passing I should like to remark that the theologian may profitably use his influence to create a still wider interest in Fabre's works for they reflect the author's unshaken faith in Providence, his admiration and awe over the perfection and purposiveness of the minutest phenomena, a faith that is childlike in its trust and steadfastness. The world is wont to make much ado over the scientific atheist. Let us, on the contrary, call attention, in season and out of season, to the men of science who are also men of faith.

Dr. Robert A. Millikan, who is a distinguished physicist and who bears the distinction of being the first to succeed in isolating an electron, prepared a recently published statement declaring that there is no antagonism between science and religion. This statement was signed by forty noted men. Dr. Millikan refers to Newton, Faraday, Maxwell, Kelvin, and Raleigh in England, and to Pasteur in France as bearing out his contention. Among present-day scientists whom he considers religious, Millikan mentions John C. Merriam, President of the Carnegie Institute at Washington and America's foremost paleontologist; H. F. Osborn, Director of the American Museum of Natural History; Michael Pupin, Professor of electro-mechanics at Columbia University; John M. Coulter, Head of the Chicago University Department of Botany and dean of American botanists.

Men of science who are also men of faith may well liken theology to the stone pillars in our observatories. These pillars extend up into the building and thus assure a firm support for all the instruments of research and observation. That support remains firm and unshakable while the rest of the structure is subject to many vibrations. All scientists may avail themselves of the support for obtaining a broader and clearer outlook, but even if they do not see the pillars or do not even understand their need, they may never scorn them with impunity.

Science does not conflict with theology. Not only is its subject matter wholly distinct from that of theology, but the methods of the two subjects are altogether different: science is experimental, theology traditional; science is the richer, theology the more exact; science the bolder, theology the surer; science progressive, theology, in comparison, stationary; theology is loyal to the past, science has visions of the future.

Instead of fearing the hostility of the scientists, the professors of theology should familiarize themselves with the achievements of the natural sciences, and they would then find that nature is, as Francis Thompson puts it, "God's daughter who stretches her hand only to her Father's friends." Even Huxley confessed that science seemed to him "to teach in the highest and strongest manner the truth which is embodied in the Christian conception of the entire surrender to the will of God." Thoreau wrote: "My profession is always to be on the alert to find God in nature, to know His lurking places, to attend to all the oratorios, the operas in nature." Our preachers may be interested in this further remark of Thoreau: "Shall I not have words as fresh as my thoughts? Shall I use any other man's word?" John Muir finds nature to be a "Godful beauty;" and the "blessed mountains" he declared to be "so compactly filled with God's beauty, no petty personal hope or experience has room to be." High on the mountain he lies, "humbly prostrate before the vast display of God's power, and eager to offer self-denial and renunciation with eternal toil to learn any lesson in the divine manuscript."

Such ideas will send the thoughts of the Friar homing to the Seraphic Saint of old Assisi and his "little brothers, the birds."

Publications

FR. BERNARD:—The scholarly paper of Fr. John Lenhart has again brought to the attention of this Conference the question whether the Franciscan Educational Conference should rest satisfied with merely convening for a few days each year and publishing the results of its deliberations in the annual Report, or whether it should amplify its scope by editing the papers read in order to reach a wider public.

In connection with this thought, I should like to give expression to a chain of ideas which perhaps might not be entirely practicable at the present time, but which might engage the attention of some future meeting and thus lead to practical results.

At the Convention of the Catholic Educational Association a few days ago, a paper was read by Msgr. McMahon of New York dealing with the product of our seminaries—the junior clergy. Emphasis was laid on the fact that however good and efficient the junior clergy may be, they are deficient in that scholarly culture and trend of mind which characterize the clergy of other lands.

Would it be saying too much to affirm that this lack of scholarship is noticeable not only among our clergy but also among the American people as a whole? We are still a very young nation. We have so far been mainly occupied with the material side of life. The clergy of America have passed through what may be called the brick and mortar period of the Catholic constructive program.

But we are not going to rest there. The most hopeful sign of the present age is the dissatisfaction with our present status—a dissatisfaction constantly growing but balanced by a corresponding serious wish for betterment. Where such healthful dissatisfaction exists, we can cherish hopes of future growth and activity.

Coming back to the subject of publications, I would mention that while we Catholics of America have had our attention focused on the material rearing of our churches and the upbuilding of our parishes, the field of scholarly and scientific research work has been held with undisputed claim by our Protestant friends and by the liberal school of thought. Great centers of learning such as the universities of Harvard, Princeton, Yale, Johns Hopkins, etc., and institutions such as the Union Theological Seminary of New York, have gone into the field with the zest of youth and produced works of scholarly worth and lasting value.

It is time for us Catholics of America to get busy and claim what is ours by right of inheritance. It were useless in a movement of this sort to rely on the initiative of individuals.

The experience of history teaches us that such an enterprise can be successfully directed only by a group of learned and influential men who are bound together by the ties of a common ideal and brotherly love. Such a body in the Catholic Church of America to-day is pre-eminently the Franciscan Educational Conference.

It would perhaps not be out of place to give a brief sketch of the work which a learned and capable organization such as the Franciscan Educational Conference might be called upon to sponsor in the future.

There is, first of all, the subject of periodicals. Scholarly and scientific periodicals, especially in theology, are a need of the times. Perhaps it might be open for discussion whether such periodicals are really possible at present or not. We still remember that last year's Conference considered the launching of a historical periodical premature and consequently abandoned the plan. Mr. Arthur Preuss, of the "Fortnightly Review," did not agree with this view of the Conference, but judged that we had both the writers and a large enough following to make such a magazine a success.

However, whether the present time be opportune or not for editing such periodicals, we can not escape the thought that we Franciscans are not sufficiently prepared to begin such publications. We can not marshal our forces well enough to publish such a periodical at regular intervals. We are just beginning to know ourselves and to learn what power and strength lie hidden away in our various monasteries and houses of study throughout the country. When that knowledge will have become more perfect, we shall have to act.

In addition to a periodical, we should have a series of works embodying the results of original research work by our Friars, and also of translations made by them of the masterpieces in other languages. Again, this undertaking can not be left to the initiative of individual Friars. It must be guided and controlled by the Franciscan Educational Conference. A remarkable example of collective research work has been given us by the theology students of Cumberland, Md. If this body of Capuchin students could produce in four years so wonderful a book as "India and Its Missions," what might not the Friars of the New World do if their efforts were directed and whipped into form by the Franciscan Educational Conference?

Then again, take the example of Mr. Arthur Preuss. His accurate and scholarly translations of Pohle's "Dogmatic Theology" and Koch's "Moral Theology," can not but bring home to us the vast possibilities which lie open to the Franciscan scholars of this country if they unite on this question and determine on some definite line of work.

Even if we do not enter at once upon this broad field of action, we should at least make a start of some kind. It would be perfectly

legitimate, feasible, and safe to carry out the suggestion proposed at this meeting of inaugurating a series of monographs to be published at irregular intervals. We have material enough at hand right now to encourage us in making such a start. To mention but two monographs which might engage the serious attention of the Conference, we have the scholarly article of Fr. John M. Lenhart and the valuable paper of Fr. Alphonse Coan to inaugurate the series of "Franciscan Studies."

This series of monographs will give the Friars who are desirous of writing, an opportunity to work out some thesis in which they are interested and an opening to have their work published.

It would therefore seem to me that we are ready to act immediately on this suggestion. In the meantime we should give the subject of other publications serious thought, and thus we shall prepare the way for solving the problem at some future meeting.

THE CULTURAL ASPECT OF THE SCIENCES

Fr. Boniface Goldhausen, O. M. Cap.

IF the value of man's life on earth is to be measured in dollars and horse power, ancient Rome and little Greece, in particular, must count as poverty-stricken nations; their engines and implements were nearer to the spear and bow of the savage than to the telegraph and dynamo of the present day. Even if we disregard the material things and take as our standard the conduct and knowledge of the ancient Greeks and Romans, we shall find that the average workingman who reads his morning paper the while he rides to his work, is probably a better behaved and an infinitely better informed person than was the average Roman and Athenian.

Historical Retrospect

The practical and useful sciences of chemistry, mechanics, and engineering which are most important factors in present-day civilization and which are driving all other sciences to the wall, were altogether absent from the ancient world. The science of the ancients, compared with that of the modern world, was very much restricted and strangely one-sided. In Greece mathematics was enthroned on high; in Rome it was studied with an eye to the profit that it might bring. The Greeks held in high honor astronomy which they called the daughter of mathematics; but the Romans studied it also chiefly for utilitarian purposes.

But even if we do not read or hear of any technical or mechanical sciences among the ancients, we must not suppose for a moment that they were lacking in so rich and complex a civilization. China represents to-day the most enduring monument of antiquity; but she tells us nothing, for instance, of her chemistry; yet we know that it is there. Peep into a Chinese town, walk through its streets, and you will find them thronged but quiet, for there is neither rumbling of coaches nor rattling of wheels. Still a vast store of chemical knowledge, traditional and empirical, must have gone into the production of the rich silks, delicate porcelains, and fine metal work.

So it was in ancient Greece and Rome. The Greek especially—with his insatiable love for knowledge, his determination to see things as they are and to study them in their entirety, and with his burning desire to be able to give a rational explanation of everything in heaven and on earth — was just as irresistibly driven to natural sciences.

The astronomical knowledge of the Greeks was systematized in the second century of the Christian era by Ptolemy, and the science of the ancients continued to be cherished during the early Christian era and throughout the Middle Ages. The Quadrivium of the Middle Ages comprised arithmetic, geometry, music, and astronomy; it never was so popular as the Trivium which comprised grammar, dialectic, and rhetoric. The Quadrivium was generally considered the domain of the specialist. The Hindu-Arabic notation is the only gift of mediaeval mathematics to the world.

Our modern ideas of the natural and experimental sciences must be traced back to the sixteenth century. Five factors contributed to give to that period a scientific character. In the first place, the Humanists encouraged a critical spirit in studying ancient manuscripts and in investigating the history of remote times; and their discovery and application of pagan writings served to bring to the attention of the educated people of the sixteenth century all that the Greeks and Romans had done in astronomy, physics, mathematics, and medicine, as well as in philosophy, art, and literature. Secondly, the invention of printing itself was a scientific achievement, and the extensive use of the art of printing enabled scientists to acquaint the whole civilized world with their ideas and demonstrations. Thirdly, we may mention the great discoveries of new routes to India and of a New World, which added much to geographical konwledge, and led to the construction of scientific maps. Fourthly, the study of a small group of scholars afforded the first glimpse of the real character of the vast universe about our own globe, and this glimpse is the scientific basis of modern astronomy. Lastly, two profound thinkers, Francis Bacon and Descartes, early in the seventeenth century pointed out new ways of using reason, namely, the inductive method of modern science.

The Copernican system and its general acceptance went to annihilate astrology and to place astronomy upon a rational

basis. Modern astronomy was suggested by Copernicus, developed by Kepler, and popularized by Galileo.

Science consequently flourished in the sixteenth and seventeenth centuries. In the eighteenth century also there were great scholars who devoted themselves almost exclusively to science. That century witnessed Newton's great achievements in astronomy. Newton's law was developed into a simple mathematical formula by means of which physics and astronomy were developed as mathematical sciences. Leibnitz elaborated a new and valuable branch of mathematics, the differential calculus, which has proved to be of immense value in modern engineering. At the same time, the first experiments were being made with the mysterious forces of electricity. Benjamin Franklin, Volta, and Galvani are names well known. The foundations of modern chemistry were laid by Priestley, Lavoisier, and Cavendish. In medicine and surgery, pioneer work was done by John Hunter, a noted Scotch surgeon and anatomist, and by Albrecht Haller, the "Father of modern Physiology." The facts which the eighteenth century physicians discovered regarding blood circulation made possible more intelligent and more effective methods of treating diseases.

One reason for the rapid development of natural science in the eighteenth century was the unprecedented popularity and favor enjoyed by the scientists. Kings granted large pensions to scientists; observatories with ponderous telescopes were built, often at the public expense, in almost every country; groups of learned men were everywhere banded together in "academies" or "societies." Never before had there been so much interest in science, and never before had there been such opportunity to learn. Indeed, it became quite the fashion in society to be a scientist, a philosopher, to dabble in chemistry, perhaps to have even a small laboratory or a telescope, and to dazzle one's friends with scientific knowledge.

It seemed as if the golden age were dawning; the human mind seemed to be awakening from the slumber of centuries to conquer the world, to unravel the mysteries of life, and to discover the secrets of the universe. Confident that only a little thought would be necessary to free the world from vice, ignorance, and superstition, thinkers now turned boldly to attack religion and morality, to criticize Church, State, and

Society, and to point the way to a new and earthly paradise. This tendency has been called Rationalism.

To meet the objections, the opponents of Rationalism had likewise to study the natural sciences. Educators began to recognize that the natural sciences had grown to be a power which had to be reckoned with in practical life. Philosophical, aesthetical, and practical considerations prompted the educators of the eighteenth century to add the natural sciences to the course of general education.

Scientific progress in the nineteenth century was not so epochal as that in the eighteenth century; and unlike most of the scientific advance in the eighteenth century a good deal of that of the nineteenth century was in the direction of applied science. Merely to catalogue the contributions of the scientists of the century to the daily life of the present would fill a book. As a result of science material comfort was exalted, and the Christian ideas of sacrifice, suffering, pain and death seemed foolishness to this age of progress. The practical scientists were frankly materialistic in their aims; from their materialistic achievements proceeded Pragmatism, the notion that the value of moral and religious ideals is to be judged solely by their practical effects, i. e., by the way they work. Influenced by evolution, even Catholic scholars held that dogma was not immutable but evolutionary. They were the Modernists. The period from 1871 till now is marked by a steady increase of indifference towards religion.

Our age has thrown open the schools, elementary and secondary, to all comers. Modern education has enlarged the scope of both the mathematical and the natural sciences. The natural sciences are to-day no less important in general education than in everyday life. All professional schools, whether of secondary or of more advanced grade, rightly demand of the general cultural schools that they familiarize their students with the elements of the natural sciences. No schools of general culture may ignore them. The educated man may not be a stranger in the new world discovered by the natural sciences, but must, to say the least, have the key that will unlock for him the intellectual work that is embodied in the scientific and technical achievements of the modern world, and must be able to discuss intelligently the train of thought that has made the dreams of inventive genius a reality.

The Relative Value of the Sciences as Compared with the Classics

We frequent "theaters" to attend a "dramatic" performance. The play may be a "tragedy," or some form of "comedy." The play may open with a "prologue." The different "characters" may please. Between the acts we enjoy the music of an "orchestra." These very terms are a symbol of the indelible mark which ancient Greece and Rome have set on our aesthetic and intellectual life.

That portion of the human race which inhabits Western Europe and America, represents Western Civilization, and this civilization is intimately related to the culture of ancient Greece and Rome. The poetry and the philosophy and the social life and the political institutions of ancient Greece and Rome and of modern Europe and America constitute a single species when contrasted with the institutions of other civilizations. Under the inspiration of Greece and Rome, the modern world has achieved in literature, art, architecture, science, mathematics, philosophy, and political thought what partly equals and partly surpasses the ancient patterns.

The imprint of these ancient patterns, either clear or faint, is on nearly all our literary forms. Epic, lyric, drama, poetry, history, biography, rhetoric, oratory, epigram, essay, sermon, letter writing, literary criticism—all are terms that betray unmistakably their ancient origin. What did the ancients achieve in literature? They invented every literary genus that we know; they drew the lines which European literature has followed; and created a body of prose and poetry which has won the admiration of the world. Classic literature is marked by grandeur, excellence, sanity, a complete humanity, a high philosophy of life, and a lofty way of thinking. We find these qualities in their lyrics and epics as well as in their dramas; we find them also in their philosophers, orators, and historians.

The classic writers lived in a world whose emotions were elemental. The interests of an early age naturally are the prime and essential interests of human nature; and the literature of such an age presents them unalloyed and uncomplicated by lesser issues. The poets made their poetry from emotions and interests that are as old as man, and have none of the refinements and complications which education and long inheritance of culture superadd to the essential stuff of human

nature. They are free from the dominance of the unessential, which in life, as in literature, is a ruinous vice. In life human beings return from a distracting variety of interests to a few simple things; or if they do not, they run the risk of losing their souls.

The simplicity of classic literature is accompanied by the highest literary art. This is universally admitted. In divining the principles of literary art and evolving the various kinds of literature no people can be compared with the ancient Greeks and Romans, and probably none can show a mass of work executed with so uniformly high a finish. Comparing English literature with that of the classics we find the former rich and profuse, following the flow of an opulent fancy, the latter reticent and restrained, leaving the reader's imagination room and need to play its part. In their theory and practice the ancient writers were true to this principle of economy. This economy stimulates imagination; it throws the reader on his own resources.

If the art of printing were lost, modern works would contract within narrower limits. The habit of writing for money, which encourages abundant production, and the existence of the printing press, which makes abundant production easy, expose us to dangers from which the classics were free. The newspapers are the worst offenders as they say everything in a superfluous and excessive way.

The third quality of classic literature is truthfulness. Classic truthfulness is spontaneous, natural, and effortless; it is not akin to that type of modern realism which, like a noxious drug, lays hold on the mind and depresses the heart — the realism which paints a black picture of human life, and leaves us no other feeling than that of mere horror; and thus gives us no complete picture of the world. Avoiding didacticism, the classic writers will not distort truth to suit personal bias; avoiding rhetoric, they will not sacrifice truth to fine phrases; avoiding sentiment and fancy, they will not gratify their hearers' feelings at the expense of truth; avoiding mysticism, they will not move away into a world of emotions. The classic writers are not excessive, because they are direct and objective, because they are mirrors that reflect life, not imperfect lenses that distort each object according to its own imperfections. This intellectual disinterestedness would in political and social con-

troversies make opposing views more intelligible and the path to truth easier and plainer; in literature it would free us from excesses; and in national life it would guard us from the materialism which, while resulting from the wonderful development of science, besets our industrial and commercial age.

Classic simplicity recalls us to the central interests of the human heart; classic truthfulness is a challenge to see the world as it is, and to shun the emptiness of mere sound, the falsities of rhetoric or sentiment, the incompleteness of writers who, instead of seeing life as a whole, ignore or emphasize a part of it as their own sympathies dictate.

It would be equally possible to dwell on the historical interest. Then we should find that for that branch of mankind which is responsible for Western Civilization, the seeds of almost all that we count best in human progress were sown in ancient Greece and Rome. The conception of beauty as a joy in itself and as a guide in life was first and most vividly expressed by the classical writers; the very laws by which things are beautiful or ugly were to a great extent discovered and laid down by them. The conception of freedom and justice, freedom in speech and in mind, justice between the strong and the weak, the rich and the poor, the pursuit of truth, freedom, beauty, excellence—all these pervade their literary and political thought.

The study of the ancient classics, as we see, opens to us by far the greater and nobler domain of culture, if we believe in an individual life founded on freedom, reason, beauty, excellence and the pursuit of truth, and an international life aiming at the fellowship between man and man. We therefore can not resist the conclusion that the study of the ancient classics is of the highest educational value.

And what is the character of the educational elements of the sciences? The educational elements of the sciences are dubious, and in consequence of their enormous mobility and progressiveness, not only books on science very quickly become out of date, but also all institutions of civilization that are based on the sciences. The classic elements of education have a kind of stationary and eternal value; they are like the beauty of the dawn, or the love of a mother for her child, or the courage of a martyr facing death; they are, like poetry, Eternal Beauty. We can not for all our progress get beyond these

things, for they are not a beauty of mere ornament and style; they are a beauty of structure, beauty of rightness, beauty of life.

"The educational value of the classics," says Archbishop Spalding, "lies in the type of mind, the sense of proportion and beauty, the heroic temper, the philosophical mood, the keen relish for high enterprise, and the joyful love of life which they make known to us." The ancient classics not only exemplify clearness, accuracy, simplicity, and regularity of speech, but they also exemplify moderation and sobriety of thought, a certain practical good sense in human affairs, a temper for equity, a respect for established order, for the laws and the established customs of society — in a word they are approved teachers of a just, enlightened conservatism of life and conduct. Science, being progressive and to a great extent dubious, by its very nature possesses revolutionary tendencies and materialistic aims which—as appears from the "Historical Retrospect"—threaten to become a menace to society.

For the priest in particular there is something intimately formative in the study of the ancient classics. The Catholic Church long ago transformed the classical Latin, adapted it to her own needs, breathed into it her own spirit, stamped on it an accurate representation of her, and made it again a cosmopolitan tongue.

Correlating the Old Cultural Subjects with the Sciences

The necessity of the study of the sciences has been referred to above; to emphasize this necessity a passage from the encyclical *Longaeva* of Pope Leo XIII. is here quoted:

"An education which takes no notice of modern science, can not be deemed complete. It is obvious that with the existing keen competition of talents and with the widespread, and in itself, noble and praiseworthy passion for knowledge, Catholics ought not to be followers, but leaders. It is necessary, therefore, that they should cultivate every refinement of learning and zealously train their minds to the discovery of truth and investigation, as far as it is possible, of the entire domain of nature. This in every age has been the wish of the Church; upon the enlargement of the boundaries of knowledge she has been wont to bestow all possible labor and energy."

The classical, however, is a harmonious education; it em-

bodies the elements of a liberal education; it imparts general efficiency; it provides for adaptability to changing conditions. The sciences embody the elements of vocational education; by means of thorough training in any one science specialized efficiency is obtained. Vocational education deals with a specific and tangible problem; liberal education with a very complex problem; the aims of vocational education are specific and tangible; the aims of liberal education are not, as it is often believed, inherently obscure, but rather they are inherently remote and inherently broad and comprehensive.

To correlate the classics and the sciences is to blend them together, to place them in proper proportion, to connect them in such a way that they coalesce into an educational whole. Correlation is necessary, for also of an education it must be true that the whole of an education is equal to the sum of all its parts.

If we take for granted the general belief of educators, statesmen, and even the man in the street, from Plato and Aristotle to the great educators of the present day, that there is such a thing as "general culture, widened vision, sound understanding, intellectual discipline," and that some studies are better "mental gymnastics" than others, the writer thinks that we have at once a true basis and a natural viewpoint for correlation. If it is generally admitted that to neglect the physical sciences is to leave a serious defect in a truly liberal, cultural, and practical education, then also the sciences must embody certain factors that belong to the elements of liberal education.

In life the classics and the sciences harmoniously meet and unite; liberal education is not opposed to the practical things of life; liberal education enters into vocational education. The more changeable conditions are in vocational life, the more we need a power that will enable the individual to free himself from all concrete details and adjust himself to new situations. This power can come only through mastery of fundamental laws and principles, the mastery of which is the proper aim of liberal education.

In his vocational life man is also utilizing the skill that he has learned from others or developed for himself; he is utilizing the truths that others have invented; he is utilizing principles and rules of procedure that have come to him from the past experiences of his fellow workers; he is utilizing the ideals,

the standards, the tastes that mankind has wrought out of its long experience.

The legitimate exercise of the professional vocation calls out all the highest and noblest qualities in man. The elements that aim at developing the high qualities of mind and heart demanded for the worthy exercise of the learned professions are the cultural and liberalizing elements. In the training of professions these elements must not only be present but they must be present in such strength as more than to counterbalance the elements which make for technical efficiency. Otherwise the professions fall and with them civilization itself. Again, technical efficiency in the learned professions is practically unattainable unless the candidate has a broad basis of cultural scholarship. For these reasons there must be in the education of the professional man a predominance of the cultural over the vocational elements. Years ago a young man might take up the study of medicine with scarcely a grammar school education, and in a few months obtain his licence to practice. The majority of our good medical schools now demand at least two years of college training as an entrance requirement for a four years' medical course, and in our better medical schools the completion of a standard college course is presupposed.

But it must be kept in mind that the professional man derives a great deal of his general culture from the study of the sciences; no specialist is able to accomplish much without the knowledge of the other sciences that are related to his profession. It is clear, therefore, that, whilst it may readily be admitted that the educational aim of the sciences is different from that of the classics, the difference between classical and scientific elements of education must not be pushed too far.

The sciences when taught and studied with a view to acquire "specialized efficiency," and for "utilitarian" purposes, assume the character of vocational education and become thus more or less disconnected from the classics; more broad, more comprehensive are the outlines of science, the scientific principles, the results of science; these are elements of liberal education, and these must be stressed in a school of general culture. Again, general educational aims of a moral character must be presented in the study of the sciences, principles and powers not limited to a particular science, but taught and insisted upon

with every school subject. By this manner of treatment the sciences are united with the classics by a common bond of unity.

Pope Leo XIII. implicitly expressed this view of correlation in his encyclical to the bishops of France (*Depuis le jour* of Sept. 8, 1899) when he emphasized the value for the priest of a study of the natural sciences, but immediately added a caution against exaggeration in this regard and advised clerics to confine themselves to the general principles and most important conclusions, especially those which may aid in defending our faith against its enemies. Likewise Pius X. (Encyclical *Pascendi* of Sept. 7, 1907) reiterated the importance of a study of these branches but warned against excess that may hinder the students' progress in the other studies of more immediate necessity.

Since in liberal education the controlling purpose, pedagogically, is not only to produce skill and efficiency, highly organized and definite knowledge, but also to expand intellectual experience, provide for deeper appreciation of those things of the social inheritance that are most worth while, and to refine tastes and create intellectual interests of various kinds, we find in our viewpoint an element of correlation which is of a psychological nature. Deep down in the love of nature, whether it be of the sensuous or intellectual kind, and in the art of observation which is its outcome and first expression, lie the roots of all our natural science; in this same love of nature lie also a great many roots of literature. All the world over these are the heritage of all men; they are shown forth in the lore and wisdom of hunter and fisherman, of shepherd and husbandman, of artist and poet. The natural sciences, then, are not exclusively enshrined in laboratories and scientific research; they are refined by art and are thus treasured in men's hearts; they have enshrined themselves in the noblest classical literature. The natural history of the ancients pervades the vast literature of classical antiquity.

This factor exerts a peculiar influence on the sciences. In the course of time ancient astronomy has been completely revolutionized as to its theoretical aspect; also physically some changes have taken place; yet astronomers tenaciously adhere to the vernal equinox as the First of Aries, although the vernal equinox is now in the constellation of Pisces; most strongly

they have opposed every attempt to introduce new constellations. Why? It is because the fine things of the world, sunrise and sea and stars and science in general, have in the classics a special quality of keen austere beauty. In the love of nature the classics and science unite and touch the same sphere of things. Science speculates, abstracts, theorizes; the prolific classical language gives soul to the objects of sense and science, and a body to the abstractions of science. The teacher who creates a live interest in the classics, especially in the classical natural history, encourages the interest in the sciences.

Embracing matter of the highest moment the sciences also develop and give culture to the mind. They deal with real, material, and practical things of God's creation; they treat of substances and energies which the mind of man has so discovered, classified, combined, and utilized as to contribute much to refinement, to the occupation of the intellect and imagination, to the happiness of the heart and to the general welfare of the human race. To study and investigate the beauties and intricacies, the wonderfully coördinated and harmonized laws and objects of nature, whether it be with the mind more than with the heart, whether one be at heart a husbandman like Cato or a teacher of the science of agriculture, whether one praise the farm with its cornfields and meadowland, vineyard and woodland, orchard and pasture, beehives and flowers as Pliny did, or whether one observe the country's geological history, or study the anatomy and the life processess of the animals that inhabit it—all this should lift up the mind to the Creator of all, should develop the mind, give culture to it, and put man in a position to be eminently practical in life. The portrayal and study of nature in all her manifold diversity is in its background, like the classics, filled with the affairs and actions and thoughts of men.

The classics supplement science. An example will best illustrate this. In the absence of any adequate system of classification, botany until the seventeenth century consisted mainly of descriptions of species. To describe accurately a leaf or a root in the language in ordinary use would often take pages. Modern botanists have invented an elaborate terminology — based upon the classics—which, however, hideous to the eye and ear, has the crowning merit of abbreviating scientific literature. Botanical writers previous to the seventeenth century

were substantially without this special mode of expression. It is partly to this lack that we owe the persistent attempts throughout the centuries to represent plants pictorially in herbals, both manuscript and printed, and hence is the possibility of an adequate history of plant illustration. The ancient classical languages surpass in variety, in simplicity, in flexibility, and in copiousness every other language of the western world and therefore are instruments that science can not do without.

On the other hand, the pupil receives his drill in English indirectly through the medium of the study of the classics and of the sciences. The sciences should be made practical enough that the student sees success in managing material made possible by the mastery of words and of the ideas they convey. Even the teachers of the sciences may in part accomplish for the student what is accomplished by the teachers of Latin and Greek.

Science supplements the classics. In education we decry the system of specialization which obtains in many modern institutions of learning; but may not a system which would strive after mental development exclusively by a severe course in the ancient classics be also considered a kind of specialization, in that it makes a specialty of mental development? Is there not danger when too much stress is put on mental training, that the mind becomes unnatural, unpractical, too idealistic, too rhetorical, too subtle? A most effective ballast for holding the mind down to the real and concrete phase of life is furnished by the natural sciences. With a diploma of the classics in hand the college graduate is often not welcomed into social, political, and commercial life, because he has been soaring too high in the realms of pure thought, too far above the actual things of life; and probably many a priest would be more practical and show more tact in the management of parish affairs, had he gone through the manipulations of laboratory experiments.

The classics and the sciences are good material for mental gymnastics; but neither the classics nor any of the sciences can give that intellectual discipline which mathematics gives to the mind. Mathematics is not only the soul of every physical relation, law and motion but also the most potent factor in the marvelous progress of modern science and the groundwork of the knowledge of the universe. It is in that world where all

entia dwell, in the great assembly of eternal verities that the spirit of mathematics has its home and its life. It is a cold world, indeed, but wonderfully illuminated, it is a world where logic reigns supreme, and it may justly be called the "Disciplina Mentis." Excepting religion and metaphysics there is no other study which brings us into closer touch with the absolute truth. The uplift to this absolute truth is in itself of the highest cultural and ethical value.

Mathematics is inexorable, pardoning no mistake, and a long familiarity with it in all its branches can not but impart to the mind unerring accuracy. One of the functions of the intellect is to reason out conclusions from principles; mathematics is the science that gives the mind facility in reasoning. In geometry the reasonings and demonstrations have been evolved by master minds during thousands of years. There is much pleasure, inspiration, culture, and profit in following out and studying the reasons of Euclid, Pythagoras, and Archimedes. By its universality and disciplinary character mathematics is from the standpoint of a liberal education, amply correlated to the classics.

Our argument becomes still stronger when we consider more closely the aims of mathematics. The results which a teacher should strive to obtain by the teaching of geometry are, for the ordinary student, as follows:

1. A knowledge of that part of the content which is fundamental and of the most importance.

2. The ability to think logically; a knowledge of the methods and principles of geometric proof and of the nature of proof in general. This involves: a) The ability to tell whether a given argument is logically sound. The student must learn to distinguish between necessary and contingent conclusions. b) The ability to construct a chain of reasoning from given material. In geometry the student learns that he has certain tools by means of which he is to prove a proposition. He also learns how to examine these tools to see which ones are applicable, and in doing this he learns the general method of applying them. He learns to analyze, arrange, and classify the material; he acquires the general methods which underlie all proofs so that when he comes to proofs of other subjects he has a clear knowledge of what constitutes a proof and of its general technique, and can apply it to other subjects.

c) The ability to think for himself. He must learn to look at a thing from all sides, to ascertain its true relation, to force every argument to its conclusions, to think through and through a subject.

3. Ability to express himself clearly. The student must be taught the value of clear expression, and in the student's work clear expression must be insisted on.

4. Concentration. The ability to shut out everything else and fix the mind on the subject at hand.

5. Constructive imagination. The ability to construct new images out of the old ones; to be able to visualize and form the habit of doing so is of great importance.

6. Rational memory. The habit of associating things so as to retain them.

7. Liberal-mindedness. The habit of always looking for new truth and leaving the mind open for its entrance. The student of geometry should be a discoverer, and get into the habit of looking for new light, and of looking at things from a broad standpoint.

8. Esthetic ability. Geometry possesses not only beauty of form, but of idea and of method. It should cultivate a habit of neatness and accuracy.

9. The spirit of honesty. The study of geometry soon shows how futile it is to practice dishonest thinking; and shows the reward of honest thinking.

10. Will power. A well governed will is essential to usefulness, and the study of geometry offers the student every opportunity to exercise it.

These results are not always obtained, but the aim should be to produce them as fully as possible. Not only the content, but also the other aims are important. The mere content of most subjects is of little value as compared with the mental and moral qualities which are to be obtained from study. All these qualities, if they are aimed at in connection with geometry, as they are aimed at in connection with the classics, will amply correlate mathematics and the sciences with the classics. In correlating the sciences with the classics the educational aims of the classics have been our guiding principle, and from that standpoint we have reached this conclusion: The abstract elements of science, and even of vocational training, are, far from being the things to be avoided, the very things which

must be kept in mind. Other viewpoints may be attractive; to the writer they seem to be artificial. Mathematics, for instance, has been correlated with the classics by reading some matter of geometry in the Greek text. This, however, is of little value, and no teacher of geometry is willing to sacrifice sound understanding to the reading of original texts.

The teacher must ever be alive to the educational points of contact between his science and the classics; this we may call the subjective element of correlation. It is certainly present, and is, without doubt, of the greatest importance. Objective correlation will be of very little use, if the teacher lacks the skill to present correlation, and develop in the minds of his students those powers which are the aim of liberal education. If the student fails to see the necessity and use of science study, it is not science, but the teacher of science who needs correlation. Finally, in arranging a course in the sciences the teacher should select those disciplines which will allow gradually to acquire the elements of all the sciences, and to interpret them in the light of a sound philosophy. Wasmann thinks that, even at the present time it is not impossible for one individual man to obtain the knowledge of the chief doctrines of the whole domain of science. If the writer were asked what sciences in particular should be coördinated with the study of the classics and philosophy to produce a harmonious and an organic education, an education that sees life in its true relations, he would unhesitatingly say: a solid course in mathematics as it gives the most obvious lesson in the strictness of logic, and introduces the scholar to the world of pure science; a solid course in physics and chemistry for on them is modern life conditioned, and they are of universal application, focus very sharply the powers of observation, and open up the world of nature to the young mind; a solid course in biology for it is the study of all living things, and without it we can not understand most of our modern literature; physical geography and astronomy for they give us knowledge of the things about us, and this knowledge should produce noble and elevated joy of life.

The Sciences as a Necessary Preparation for Philosophy and Theology

Scholastic philosophy is the "philosophia perennis." Its environment varies with the age, but it can always adapt itself thereto with perfect harmony; and it ought to be adapted to present-day exigencies. A certain amount of science is necessary for the seminarist to understand his philosophy in its relation to modern problems.

The first treatise to which the philosophical neophyte is introduced is that of logic, which is now generally taken to embrace both dialectics and criteriology. The former has not progressed essentially beyond the form given it by Aristotle. It may consequently, for practical purposes, be regarded as a closed subject, and does not require any special scientific training. Yet even here we must say that the best preparation for dialectics is a sound training in mathematics, which indeed supplies striking examples of syllogistic reasoning. Of the great ancient Greek philosophers history says that they had been also great mathematicians. Why has ancient Hellas produced so many distinguished philosophers? We may not be very wrong when we say that it was because the Greeks had early developed a remarkably perfect mathematics. Up till about the year 1900 the elements of geometry were regularly taught, throughout Europe and America, after a textbook written by a Greek called Euclides in the fourth or third century B. C. That textbook lasted over two thousand years. According to Francis Bacon mathematics is the A B C of philosophy.

Of criteriology, however, it can not be said that it is a closed subject. Here a general knowledge of scientific method will not be sufficient for the student to defend his doctrines. Take the question of idealism for instance. Is the student to refute the objections on which modern idealism rests, by merely telling his opponent that his system is repugnant to common sense and action? Such indirect apologetics is never helpful in the process of conversion. Indeed, if the student is to have any conviction of strength even of his own system, he must be able to show that the objections are capable of a full and adequate explanation in terms of critical realism. Hence he must have some idea as to what physicists mean when they reduce secondary qualities to mere movement, and he must

know accurately the anatomy and physiology of the sensory organs.

In cosmology the student is asked to accept a constructive theory as to the nature of matter whose existence he has "critically" established. He finds himself at once confronted with a rival theory of mechanism, which has a very wide sway in the world of science, and which is seemingly supported by an array of irrefragable facts. If the student has not sufficient knowledge of chemistry to distinguish between facts and hypotheses, so that he can neither prove his own thesis nor understand that of the mechanist, his mind is doomed to wander in that sunless background of obscurantism where intellectual growth becomes impossible. This applies with practically the same force to other cosmological theses. Speculations on the nature of place and space, of motion and time, of quantity and continuum, and of mass and energy, can not be treated in any adequate or satisfactory manner unless illumined by the light of science.

The direct deduction from the foregoing observations is obviously that the teaching of Scholasticism as a doctrine can not be successful unless accompanied by some training in the natural sciences.

On the other hand it must be said that philosophy forms a solid background for the sciences. The knowledge coming from the study of the sciences is knowledge gained and verified by exact observation and correct thinking; it is knowledge which we have forced from nature by constant and close observation and then have taken the facts thus found and through our intellect have formulated them into a sysem, and have read a meaning into them. Without logic, epistemology, and metaphysics, without a thorough understanding of the problems of philosophy, the scientific facts can not be used in the classifications of ideas and thought processes. The laws of thought and of knowledge must be known.

If these laws were better known and more widely applied in the sciences, there would be less misunderstanding and less conflict between science and faith, for this conflict can generally be traced to looseness of thought, and to the ignorance of logic and of the first principles that underlie all correct thinking. Now it is apparent that if the student has made observation in the laboratory, he will have the great advantage in

drawing his examples and his proofs from actually existing things which he himself has handled, and consequently he can present a more convincing argument.

There are also certain points of contact between science and faith. Biology and its allied sciences, for instance, have occasioned serious discussions regarding the existence of the human soul, its spirituality and immortality, its difference from the life principles in the animal kingdom, also regarding the creation of the world, of plants, animals, and of man, eternity of matter, impossibility of miracles, etc. If, then, the cause of science is falsely set against the cause of religion, it behooves the Church to educate her priests in the elements of the sciences that they may be able to distinguish between true science and false science, may know the bearings of science on faith, and see their points of contact.

The Net Value of the Sciences for Our Future Priests

The sciences render great service to the priest in his vocational life. The priest is brought into contact with general educational movements. So far as he may attempt to escape such contact, he impairs his usefulness to the Church; and so far as he may be expected to do his full duty in this respect as in all others, the sciences will give him an excellent equipment.

Among the effects produced by modern education is a certain way of looking at things, perceiving their relations, connecting new ideas with old, stimulating and sustaining interest, translating thought into action, and consolidating action into habit. This present condition of thought calls upon the priest, especially as apologist, to interpret the creed in terms of modern thought, to explain its bearings on modern problems, ideas, and scientific hypotheses. By proper adaptation of the sciences, which are closely woven into the fabric of vocational and practical life, the priest can make his people feel that the truth which he imparts is not anything contrary to their ordinary interests, and thus he may hope to make religious thought, the belief of our faith, and the divine commands thoroughly a part of the ordinary thought and volition of his hearers.

Modern thought has been most successful and most fruitful of solid results in the various departments of physical science. Therefore, though great good is doubtless to be hoped from the contact between faith and all departments of modern thought, the greatest good will surely be gained, the best re-

sults achieved, the significance of faith most enriched, its application most extended, and its development most furthered by the employment of the main results of modern scientific research in the service of theology.

The priest, however, also has duties which bring him into more direct contact with educational work. While he may not be called on to teach in school or college, he is none the less in a position to help the teachers, and it often becomes his duty to assist them. Nothing contributes more to the efficiency of the school than the confidence which the teacher feels in the priest whose knowledge of educational matters enables him to realize difficulties, to give wholesome and practical advice. Scientific methods of teaching are based on the study of the growing mind, and on the conclusions of biology, physiology, and psychology. The priest, when versed in the sciences, has the advantage of knowing the reason why certain practices are adopted, or the use of certain devices discontinued. He is less liable to make mistakes, and is able to impart to others the secret of success. It is certainly a curious situation that confronts us when the priest from the pulpit inveighs against a philosophic theory, while in the adjoining parochial school the same theory in its practical consequences is daily applied, because the teachers are often dependent on institutions and textbooks whose principles are opposed to the very things for which our schools exist.

There is still another and wider field open to the priest for turning to useful account his knowledge of the sciences. It is in the large field of public discussion that he may often find the best opportunity of using his knowledge of the sciences to the best advantage. In most of our cities and towns the Catholic priest is recognized as a citizen of worth and standing, and it depends largely upon himself whether his beneficial influence shall be practically restricted to his own flock, or through the local press and other means be extended to his fellow-citizens generally. In this way a great deal can be done by the priest to clear away misunderstandings, to show a fairer and fuller understanding of Catholic doctrine and Catholic education. The occasion is now more frequently offered the priest as the exponent of our principles, to share in the discussion of matters which all acknowledge to be of grave import for the welfare of the people. The misunderstanding which has grown

up between Christian philosophy, faith, and the men of science, is responsible for much atheism and agnosticism that has prevailed among men of science during the past two centuries, and it is at least partly responsible for the widespread opinion, which is to be found even up to the present day among non-Catholics, that the sciences must assume a hostile attitude towards religion. On the lecture platform, in the gatherings of educators, in the columns of the press or the pages of technical reviews there is for the priest a better opportunity than ever before to present the claims of religion and to correct wrong impressions.

Since man has not only a body, but also an immortal soul, since he is created not for time, but for eternity, since he is made for God, it is impossible that materialism, an evil outgrowth of science, should finally satisfy his nature. Human nature is on the side of religion. Science is partial and one-sided. Science with its practical eye feels no sympathy when the heart breaks in anguish; it speaks no word of relief when tears gush forth and sorrow sears the soul. But out of the bosom of religion flows the refreshing stream of comfort. The priest, then, who is able to show what relation faith bears to modern thought, where it agrees with the results of modern thinkers, where it corrects them, and where it supersedes them, is ever welcome; his voice and pen, whenever they reach the outside world, are like an instrument correctly strung, which, when it sounds, makes men listen; and men respond because they are convinced that, whilst others touch the

> "..... lyre to please the ear
> And win the buzzing plaudits of the town,
> The priest sings his soul out to the stars
> And the deep hearts of men."

DISCUSSION

FR. SIMON:—Before taking up the discussion of the excellent paper of Fr. Boniface it may be well to recall briefly the significance of the term science as given in the learned paper we heard last night.

Meaning of Science

I shall attempt to restate Fr. John's definition by quoting from John Dewey ("Cyclopedia of Education," s. v. Scientific Method): "The term science in the sense of knowledge (scientia) was long used to include the entire subject matter of study. During the last two or three centuries the term has been commonly restricted to one of two senses: first, as a general method of organization or investigation applicable to the phenomena of almost any field; second, as a term to include the various aspects of the study of natural phenomena; that is, natural science."

This last usage of the term is, indeed, very much restricted and was unknown to Aristotle and St. Thomas. Aristotle defines science as a sure and evident knowledge obtained from demonstrations. This is identical with St. Thomas' definition of science as the knowledge of things from their causes. Up to the time of the Renaissance, science continued to be a synonym for general knowledge. In the middle of the 17th century Galileo, Francis Bacon, and Descartes considered science rather as system, or methodology, or logic. In the 18th century science became a religion. In the 19th century men of the type of Littre and Renan worshipped science as the idol that could explain the secrets which were mysteries in religion, and hence they declared that science ought to supplant religion.

It is significant of the modern trend towards the earth earthly to distinguish natural science as science catexochen. Though we may contend that theology, the queen of the sciences, should be thus distinguished, we can not ignore modern usage in language matters. Yet this does not mean that we should condone such an abuse of the term as would honor baseball playing, prizefighting, or shaving with the name of science.

Such an abuse of the term may be common among the masses. But it is our duty not to descend to the level of the masses, but to lead them aright, and thus to raise them to higher heights: the salvation of the masses lies in following right leadership. The late war was fought, so we were told, to make the world safe for democracy. But if the world itself would now be safe, the democracy must be led aright. If the leaders would lead aright, they must have right ideas, and right words are essential to right ideas. Hence I wish to go on record as pleading for an exact use of the term science.

Brunetiere defines science as "a relation between two terms that are unequal but ever changeable: the human mind and external nature." Hence he argues that science does not deal with the essence of things as does philosophy; nor is it purely subjective, but it is a "relation" between mind and matter. The same writer deplores the sovereignty conceded to science which forthwith presumes to rule art, philosophy, ethics, and religion out of court. Cf. Brunetiere. "Discours de Combat, L'Evolution du Concept de la Science." Paris, Perrin, 1912.

FR. BONIFACE GOLDHAUSEN:—The statements of Fr. Simon in which he calls attention to the abuse of the word science—the term being applied to many trifling things — are certainly true. However, Fr. Simon agrees that the meaning of the word has somewhat changed in the course of time.

Science, in the first place, denotes knowledge; i. e., the term is taken in the subjective sense expressing a mental habit. "Scientia dicit essentialem ordinem ad scibile," is a teaching of philosophy. As a mental habit science conveys the notion of knowledge in some way perfected; it denotes comprehensive knowledge. A mere description of natural phenomena, for example, without any explanation, or reference of them to the laws of nature, would, indeed, indicate knowledge about nature, but could not claim to be science. Science which is knowledge systematized, thought over, reduced to order, is thus contrasted with the scrappy, unassorted knowledge of the uneducated people.

Science as a mental habit must not be exaggerated. To many the word has a magic sound: there arises in their minds the image of a somewhat superhuman being. Open on his lap lies the book of wisdom in which all mysteries are solved; in his hands he holds the flaming torch that dispels all darkness. This infallible superman can settle all problems, silence every contradiction. In the world of reality this personified "Science" is nowhere to be found.

Aristotle demands intrinsic evidence, either direct or indirect, of principles as an essential note of science. A system of conclusions not deduced from principles at least radicaliter per se evident to natural reason, meant with the great philosopher opinion or belief, habits which fall below the dignity of science, whose first attribute is to give certitude, to fix the mind immovably to its object.

It is for this definition of science—to which past ages adhered—that the older theologians dispute much and subtly regarding the claim of theology to the title of science. Some were in favor of calling it faith, or an unclassified habit. The followers of St. Thomas, on the other hand, holding close to the Master's word—"dicendum sacram doctrinam esse scientiam"—have always defended its character of science.

The modern conception of science is much wider than that of the ancients. The word, as we use it now, does not imply that all knowledge which we call science is certain and free from doubt; it includes certain as well as uncertain knowledge, hypotheses, and even activities of research together with their methods.

Science, when taken in the objective sense, denotes a systematized body of demonstrated truths. Science thus embraces all those branches of knowledge of which the subject matter is either ultimate principles, or facts as explained by principles, or laws arranged in natural order as textbooks will give them. Natural science is the summary of an investigation and presents the causes of natural phenomena arranged in an orderly way. The modern view of science, however, applies also here.

The individual sciences are distinguished one from another principally by the subjects of which they treat; there are, however, other principles of the classification of sciences; thus we speak of theoretical and practical sciences.

By our modern wide conception of science — applying it often to mere theories, proceedings, methods, etc., — confusion is certainly caused in the minds of many. Were we to go back to the ancient

idea of science, the number of sciences would be greatly reduced — the ancients had only seven—and we should have fewer scientists.

It may, indeed, sound rather strange to many a one that the natural sciences, of whose real causes and true explanations we perhaps have least certainty, and which are characterized by the greatest number of hypotheses and theories, should preeminently enjoy the title of "The Sciences." All we can do is to blame modern usage. Yet it may be said that our broadened view of science, the great increase of the sciences itself, are but a natural sequence of a steady advance of culture. "Prius vivere, dein philosophari," is an old proverb. Applied to the life of nations and to mankind at large, it means that a certain degree of prosperity is necessary, and that men must possess something beyond the mere elements of culture, if the sciences are to develop and to flourish. Progress of research means progress of science. And the rapid progress of modern civilization has established ready communication of the nations of the whole world with one another, it has made the world a laboratory for anthroprological, ethnographical, biological, and geological research. Meteorology, climatology, comparative geography, and many of our modern sciences would have never come into being without the progress of civilization, or without the intercourse of the nations and peoples of the world.

But science has its seat, after all, nowhere else than in the human mind. For this reason the mental habit, denoted by science, is ultimately the only true meaning. When we think of the sciences as distinct bodies of truth or of knowledge, the distinction is a mental one, due to the mind's power of abstracting. Hence we should, indeed, guard against conceiving the sciences as "existing" separately from one another or apart from the human mind. There is no "science" just as there is no "knowledge" except in the individual minds. The sciences do not even exist in books. What exists in books is a system of visible symbols of language; and the language is the expression of thought, of knowledge, of science.

FR. LIBERATUS:—One thing brought out well by Fr. Boniface's paper was the point of contact between priest and scientist, or the frequency with which the priest must deal with scientific facts and laws.

The Priest and Science

Our textbooks and reference works on moral and pastoral theology refer to such things often enough, and sufficiently. True it is, we need not have anything like an exhaustive knowledge of biology or medicine, or of any other science, in order to fulfill the duties of the ministry. Still it is also true that the more knowledge we have in this respect, the more efficient will be our equipment for the work of the priesthood.

Homiletics could surely profit by something better than a mere smattering of the sciences. Sacred Scripture itself, both the Old and the New Testament, makes frequent use of scientific facts and laws to illustrate and confirm the word of God. And the preacher, the exponent of God's word, may fruitfully imitate the method inspired by the Holy Ghost.

We are told that all nature is but a book from which we may learn the power and beauty and the other manifold attributes of the Creator, and that each fact of nature should thus be made a stepping-stone to nature's Author. But the trouble with our age is that we stop short with the facts of nature; many of our sophisticated grown-up

children in the school of life can not or will not learn the Creator from the creature. As teacher, then, must the priest know his text-book well enouph to be able to teach his class.

Moreover, the priest must not only lead his people to God, but he himself must lead the way. He himself must be holy if he is to sanctify others. Now one of the means of personal holiness is the practice of the presence of God, and this practice, in one of its methods, consists in this that from the creature we seek to know God, and to realize His sacred presence with us. Was not this the method employed by our holy Founder, and with such excellent results?

Time was, too, when the priest was expected to be a sort of walking encyclopedia of knowledge concerning the sciences. People have indeed outgrown that condition, but the priest is not relieved of the need of such knowledge. As a matter of general education the priest is expected to be as well informed, yes, even better informed, than those whom he customarily meets. Himself, his Alma Mater, even the clerical state is judged by his showing. And most people are not indulgent critics!

Lastly, let us enter a plea for a "hobby." A hobby is a wonderful thing—evidently, only when indulged in within the proper bounds; otherwise it becomes a crime—and, though most priests have comparatively little time for such indulgence, for some it is a necessary thing if they are to avoid idleness and its dreadful consequences. And there is no more fascinating hobby than just some branch of science.

Now, it is true, no man can be a master of all the sciences; and no priest as such is or can be expected to be a specialist in any one of them. But conversance with the sciences has so much usefulness in the priest's life and work, and provides so much pleasure, that it is distinctly worth the while to instill into our young men a taste for the sciences, that of their own accord they will later seek what for want of time was withheld from them during their course of training for the priesthood.

Cultural Value of Science

FR. FELIX:—Fr. Boniface's paper should be an inspiration to our science teachers in particular and to our teachers and students in general because it brings out so well the cultural value of a very important subject of the curriculum. It is strange that there should be any need of demonstrating the cultural value of the sciences. They are obviously needed to round out the education of the young for they respond to various interests of human nature. There is first of all the empirical interest in the variety of living creatures, and then the speculative interest that inquires into the conditions and causes of life. The aesthetical interest, too, finds its proper object since, on the one hand, it observes and studies the beauty of forms and, on the other, sympathetically enters into the life of nature. Natural science also offers food for the religious interest since the friend of nature

> Finds tongues in trees, books in the running brooks,
> Sermons in stones, and good in everything.

The study of nature fosters the love of home and country in as much as it familiarizes us with our natural environment. Communing with nature also acquaints us with the quiet reign of law in the visible world, and hence calms the heart when about to cry out with the

bitterness of life's struggles. The mind that is weary of intellectual labors is refreshed by the observation of life in nature: to preserve health of mind, one must use his eyes, ears, and other senses; one must assimilate colors and forms, instead of letters and numbers; one must return occasionally from the past—to which our books and studies generally transport us—to the sensuous present.

All this holds for our students. The natural sciences, if taught properly, appeal spontaneously to the boy. Especially if much occupied with language studies will he welcome the opportunity to look at something tangible. But from the looking at these tangibe things the boy will naturally proceed to observe, to compare, and to generalize. When classifying individual specimens the boy reaps the benefit of the logical exercise contained in passing from the specific to the generic, and the inverse of this exercise he has when he must find specimens of a certain family or group. Thus natural history affords in concrete things the same logical exercises as the language studies require in abstract matters.

Hence the study of the systems of natural history affords valuable intellectual gains. But even greater gains are obtained by studying the objects of natural history as associated in the units that are based either upon the practical needs of life or upon the conditions obtaining in nature itself where the different creatures and beings depend upon one another. By following up human aims and relations we shall connect natural history with the humanistic disciplines, and by tracing the life-units in nature we shall elicit real sympathy with nature and discover internal unity in what seemed wholly unconnected. For illustrations of this theory I shall refer you to Willmann's "Science of Education," Vol. II, pp. 238-239; cf. also pp. 149ff.

If the teacher discovers that his scholars dislike taxonomy, the science of classification, he should not lose heart or consider them hopeless. So eminent a naturalist as Fabre abominated taxonomy and often complained about the "barbarous terminology, the nomenclature which changes from day to day, and becomes more cacophonous." He excoriated "the impaler of insects, who cares more for the niceties of nomenclature than for glorious realities. He classifies his subjects, dividing them into regiments with barbarous labels, a work which seems to him the highest expression of entomological science. Names, nothing but names: the rest hardly counts."

All that has been said holds of the disciplines classed under natural history and biology. But even more urgent reasons compel us to stress physics and chemistry in our course of study. Both sciences deal with the deeper study of natural phenomena. Modern life is unintelligible without a knowledge of physics and chemistry. Modern civilization is in great part based on the discoveries and achievements of physics and chemistry. These sciences have enriched our life with many conveniences, comforts, and helps which the educated man should not use without understanding, as he ought to recognize them as products of specific mental activities. They embody much valuable thought, and it is the province of science teaching to reveal the mental processes that created them.

The cultural value of the sciences should appeal in a special way to the Friars who are the teachers of prospective priests. Our prospective priests are called to be leaders in the modern world, and to be really at home in the modern world they must needs be at home in the natural sciences.

However, if the cultural value of the sciences is missed in some schools the blame may be laid upon false methods of teaching. If the teacher has nothing but a textbook and a blackboard for teaching science, his results must be meagre indeed. Or if he uses the subject merely for conveying information instead of showing the thought processes involved, there will be little cultural value obtained. The introduction of laboratory equipment and the use of experiment and observation furnishes an indispensable factor in the teaching of science, yet it does not of itself meet the entire need. A student may gain facility in the manipulation of materials and apparatus without gaining an insight into the significance of what is done from the standpoint of its role in genuine thinking or the making of valid knowledge. The material must be selected and disposed so that one part is a logical conclusion from other parts, while in turn it serves as a premiss from which, in combination with other parts, still further conclusions may be drawn.

Methods of Science Teaching

Consequently the science teacher should employ as much as possible the method of scientific research. In this way the student will himself witness the gradual elaboration of the scientific truth, and he will not only understand the truth more thoroughly, but will find it easier to remember the scientific fact. This will relieve the memory, and such relief is needed in these days of overcrowded curricula.

The method of scientific research will also teach our students wholesome reverence for scientific truth since they will realize some of the difficulties connected with its discovery. Our students will, furthermore, meet many new problems in their own research work, and hence they will never feel cocksure about having reached the end of scientific investigation. They will realize the meager facts of experience or experiment, and will never be betrayed into the making of statements unwarranted by the premisses.

The vitalizing of science teaching is an important phase of the large subject of method. Too many teachers of the sciences go through the world with a pair of scientific spectacles which have been stained the color of abstract facts for the purpose of filtering out the rays of the beautiful, interesting and vital science facts of the world that surrounds us. Or we may even make bold to say that these teachers are pedagogically dead, and are buried under six feet of abstract facts and formulas. The only way to resurrect these teachers is to reorganize the science teaching around the beautiful, the living, and the active world.

Vitalizing Science Teaching

It is well known that some of the most important discoveries made in the sciences have been occasioned by reflecting upon what was close at hand. The hammers of a smithy led Pythagoras to the discovery of laws of sound. Galileo discovered a law of mechanics by observing a swinging lamp. The falling of an apple led Newton to discover cosmic laws. The steam issuing from a boiling teakettle led Watt to discover laws of the theory of heat. To vitalize science teaching we must similarly deal with the phenomena of the pupils' environment.

In this way we may also teach our pupils the important truth that science study should be based not on book knowledge but on direct observation. Fabre was called the "incomparable observer" by Darwin, and the French naturalist says of himself: "My faith in what I read in print is of the slightest; I prefer to go straight to facts. Before

making a statement of any kind, I want to see, what I call seeing. It is a slower and more laborious process; but it is certainly much safer."

If the teacher does not adopt the same method in his science course, he will never create or preserve a deep interest in science, and his results will be sad to contemplate. In a test made about five years ago in a normal school three questions were asked in a class of over two hundred first-year students. All these students were graduates of a high school and entered with physics and chemistry as prerequisites. They were asked these three questions: What is a molecule? What does it look like? Have you seen one? In most cases the answers were interesting. A number explained a molecule as a small round thing in things. One young woman insisted that she had seen them. Several said their teachers had seen them.

A college president asked some students whom he met in an elevator what caused the strange feeling in their stomachs when the elevator dropped suddenly, and they looked at him with peculiar expressions in their eyes because he had asked such a question, and one laughingly said, "I don't know." The president queried further, "Have you ever studied physics?" "Yes, last year." "Can you not apply some principles of physics to this thing?" He said, "I have not thought of it before." And truly he had not thought of it before.

A science teacher asked a graduate of the science course why ice steams on a hot day. The student ventured this explanation: "Because the ice evaporates and you can see it go."

Results like these can be traced to the lifeless teaching of science. A chemistry teacher wished to discover why her class was so listless. She therefore passed small slips of paper around asking each student to write, without signature, his reason for electing chemistry. It was startling to her to find only four in sixty who intended to use the subject for pharmacy or medicine. About one-tenth were in the class because they had found another science course interesting, and had blundered into chemistry hoping to be entertained. Another tenth were there for college credit, and all the rest were in class because chemistry was "in their course." All the failures were in this last group, and here was her "vitalization" problem.

It would take me too far afield to give the various devices the teacher employed to create a vital interest in chemistry. Some students became deeply interested when the teacher asked them to assist her in analyzing samples of illicit liquor. Another group of students with military inclinations was permitted to experiment with explosives. One group of the class was told to answer an appeal of the mayor who asked for analyses of the unsanitary city water. Other students tested milk from different dairies, varieties of lard and butter substitutes, jellies, sirups, brands of baking powder, and some of the best advertised brands of vinegar to see if there was any violation of the Pure Food Law. The class also "digested" in test tubes all sorts of foods for the edification of the physiology class.

In this way chemistry stepped out from between the green covers of the textbook and became a very companionable ally. The head of the science department in one of the largest high schools of the West stated in a lecture that he had never seen a class which did not hate laboratory experimentation. But laboratory experimentation had taken on a new meaning for this particular class and was warmly welcomed as teaching truths that were really worth while. The truths and facts that these students learned came to them through industries vital to their community, and when a subject is translated into the

life and home of a student it ceases to be an alien enemy. The class had also acquired the scientific attitude—that very desirable species of what Carlyle would call divine curiosity, which was stimulated by the charm of exploration and discovery.

All these fine results were obtained by obeying the principle of pedagogy which demands, as John Dewey says, "that the growth of scientific problems out of the situations of everyday life be taken into account, instead of plunging at once into the technical scientific material without a modulated transition, and that pains be taken to insure application of scientific results to the interpretation of everyday situations." The teacher will find the following two books helpful in this connection: P. G. Beer, "Chemistry as Applied to Problems of Home and Community," Lippincott, 1923; "Chemistry in Everyday Life," Appleton, 1923.

In this way we may also hope to bring home to our students the simplicity of the basic facts and fundamental principles of the sciences. In this connection it will be well to remember what John Fiske says in his "Destiny of Man" (Ch. VII.): "Herbert Spencer has somewhere reminded us that the crowbar is but an extra lever added to the levers of which the arm is already composed, and the telescope but adds a new set of lenses to those which already exist in the eye. In a very deep sense all human science is but the increment of the power of the hand. Vision and manipulation—these, in their countless indirect and transfigured forms, are the two co-operating factors in all intellctual progress."

But we must never permit ourselves to forget that the findings of the sciences constitute only a partial need of our culture. Their usefulness is limited to supplying knowledge about instruments. They do not give us ultimate ideals; they can not provide a pattern for the whole of life, but only the means to follow the pattern. It is only the whole course of study that can satisfy the whole man, and unless our science teaching is correlated with the other subjects of the course of study it can not produce the best results.

Correlating Science with Other Subjects

Hence the interests of our students demand that science be correlated with the rest of the course. Science itself demands this correlation. Science is not the whole truth. It is only a part of truth. And if some scientists have lost their balance and make exaggerated claims for their subject or their conclusions, the cause may be that they have lost sight of the whole body of truth and can not see how their subject is interconnected with, and even dependent upon, other branches of kowledge.

Fr. Boniface has given us valuable principles for correlating the sciences with the old cultural subjects. In the preceding I have tried incidentally to show how the same principles may be applied in correlating the sciences with other subjects of the curriculum. Still other ways will readily suggest themselves to the thoughtful teacher.

The professor of dogmatic theology must be at home in science to prevent his making erroneous claims, for instance, when dealing with the evidence for the supernatural. The professor of moral theology must take regard to customs and manners as influenced by the progress of science. He must also instruct the prospective confessors how to treat pathological soul conditions when the advice to consult a neurologist or to take a course in physical culture may be more salutary than the counsel to wear sackcloth and ashes. The

professor of exegesis is confronted on all sides by the specious arguments adduced by certain scientists against the truth of the Bible. Other points of correlation between the natural and the sacred sciences have been touched upon by Fr. Liberatus.

The writings of the Rev. Augustine Gemelli, O. F. M., have thrown a new light on the services that science may render to the priest. Fr. Gemelli had been a physician and surgeon with considerable experience in the practice of medicine before he became a Franciscan. After being ordained priest he devoted himself to the scientific study of medicine, and produced a number of books dealing with biological problems and criticism of the assumptions of modern scientists, such as Haeckel and Lombroso in their respective spheres. Later the question of how to combat the degrading moral tendencies of these teachers engaged the learned Franciscan and suggested to his mind a plan which would satisfactorily answer all the needs of confessors in the field of pastoral medicine. This plan was later enlarged to embrace the publication of seven volumes, the scope of which may be gleaned from their titles: I. Non moechaberis; II. De scrupulis, eorumque natura et causis; III. De matrimonio; IV. De psychopathologiae pastoralis principiis; V. De abortu et de operationibus circa foetum; VI. De masturbatione; VII. De hygiene ecclesiastica.

Science and the Cure of Souls

To see how thoroughly the author treats his subjects, we need examine only a few features of the first book of the series. In pointing out the medical remedies for preventing and curing wrong or dangerous aphrodisiac tendencies, the author suggests simultaneously the reasons and methods of treatment in various cases and under different circumstances. The proper system of safeguarding and instructing youth, general rules for regulating their conduct, reading, recreation, are clearly enunciated. The subject of hygiene, the use of food, drink, tobacco, physical culture, sleep, spiritual activity, receive due treatment. A separate chapter is devoted to a "Schema rationalis therapeuticae" in which the reader is instructed in the proper mode of diagnosing and classifying the remedies of aphrodisiac evil. The effect of baths, the efficacy of certain drugs, of hypnosis, electricity, and divers surgical operations are judiciously pointed out; and all this with due recognition of the spiritual element, the fruits of the Redemption and the grace that flows from the Sacraments of Christ's Church.

It may be remarked, in passing, that this Franciscan author is now Rector of the University of Milan.

Fr. Boniface has shown that there is hardly any subject of the course of study that is so urgently in need of being correlated with the sciences as philosophy. But in correlating this subject with the sciences the philosophy professor will receive scant assistance from the current textbooks. Most of these textbooks give too much space to the speculative element and practically ignore the empirical. Fr. Jerome Trumpke, O. F. M., discussed this topic at the first Educational Conference of the German Friars, and declared that the textbooks in Scholastic philosophy resemble a tall structure resting on a very narrow foundation, but spreading out farther and farther the higher the building rises into the air so that the observer is in deadly fear of the catastrophe that may occur at any moment.

Science and Philosophy

Our textbooks in philosophy seem, in fact, to have been written centuries ago, so few are the traces of the modern progress in science

that they contain. This reactionary attitude may be held responsible in part for the scant attention given to the "philosophia perennis" by the modern world. It is unfair to present such textbooks as offering the fruits of the genius of Aristotle, whom H. G. Wells calls the "first great observer," whose motto was: "Let us get at facts," who was above all things objective, and who had a staff of one thousand men observing beasts and insects, who thus used induction, while Plato preferred the deductive method. The textbooks are likewise unworthy of the great masters of medieval Scholasticism for they were wide awake, with both feet on the ground of reality, and intent on availing themselves of all the science and knowledge of their age.

W. G. Ward may have had similar conditions in mind when he wrote with his characteristic vehemence to Newman in 1860: "The whole philosophical fabric which occupies our colleges is rotten from the floor to the roof. Nay; no one who has not been mixed up practically in a seminary would imagine to how great an extent it intellectually debauches the students' minds." (Wilfrid Ward, "The Life of John Henry Cardinal Newman," London, 1912, p. 473).

Still there is hope for better things. The neo-Scholastic movement as sponsored, for example, at Louvain University may well teach the professor of philosophy how to combine the speculative with the empirical so as to train his students to defend the ancient faith with modern weapons. If so trained they will be able to explain difficulties like the following which have been presented by Austin O'Malley, M. D.: "How are the new facts of biology to be interpreted by the venerable teachings of metaphysics, cosmology, or psychology? On one hand, biologists have been able to separate cells, tissues, organs from an animal and transplant them to another animal; explant them from man to animal and vice versa. They have extracted, for instance, the heart from the body and after prolonged separation under due conditions caused it to repulsate. Tissues have been made even to live and grow after the death of the body to which they belonged. And so on. On the other hand, it is a cardinal thesis of philosophy as well as a defined doctrine of Catholic faith that the soul is the substantial form of the body. All vitality, vegetative, sensitive, and intellective, in man emanates from the soul as its fontal principle; just as all vegetative and sensitive life in the animal organism springs from the one single form or principle of life. Moreover, the soul of man is essentially and integrally simple. The same is true of the root principle of life in the higher animals. Now how are we to adjust these philosophical positions with the recent discoveries of experimental biology?"

Instead of going into further details about correlating science with the other subjects, I should like to refer briefly to the one bond that connects all the subjects of the curriculum very intimately with the sciences, namely, the concept of their end. Willmann (l. c., pp. 154-155) says on this head: "The innermost nerve connecting the moral and the natural sciences is the concept of their end. Though we may not say that modern physical research has cut this nerve in twain, yet it has much neglected it and has thus impaired the usefulness of the teological concept as a guiding principle. According to the older conception, which was based on ancient idealism, the end was the metaphysical principle. The good was regarded as the final cause, not only of our striving, but

The Bond Connecting the Moral and the Natural Sciences

of all happenings; the idea was considered as prior to the corporeal world, reason as prior to nature, the perfect as prior to the imperfect, and liberty as prior to necessity.

"Francis Bacon attacked this position with the specious argument that the final causes are like the Vestals consecrated to the deity, who are, indeed, venerable, but withal barren. The majority of modern naturalists have accepted his views, and have substituted the mechanistic conception of nature for the older organic view. This change has, it is true, produced some good results in individual cases, yet it has isolated the natural sciences from the moral principles and has estranged the former from the idealistic methods of study. The naturalists have thus bartered the whole truth in exchange for half the truth, and this was too high a price, even if the partial truth be ever so fertile and (as in the present case) practically useful. To Bacon we may say that the Vestals were, though barren, yet not useless; they watched the sacred fire, and their virtue elevated and hallowed all womankind."

With proper attention to this connecting bond of the final end, the natural sciences will be recognized as the means for giving us glimpses of the one Truth which is God Himself; and to reveal more and more of the divine Author and Essence of all truth is the highest aim that the Franciscan teacher of science may conceive for himself or his students.

An Apology for Mathematics

FR. CONRAD LINK:—Before closing this discussion it may be in place to enter a plea for mathematics. On the part of the teachers of the classics, it is often objected that in our preparatory seminaries mathematics is inimical to the study of the classics, besides being altogether useless. One can become a priest, they say, without a knowledge of mathematics, and one needs at the most only an inkling of arithmetic.

In answer to the first objection, permit me to say that the classicists have no better friends than the mathematicians. Far from being at strife, mathematics and the classics go hand in hand in the formation of genuine culture. As the field best tilled produces the best fruits, so the mind best cultivated by mathematics produces the best fruits of classical knowledge. It is true that some brilliant minds have not enjoyed the blessings of mathematics, just as the uncared for soil sometimes produces rare flowers. These are by way of exception. Exceptions, however, only prove the rule.

In general for the study of the classics, there is required: 1) ability to think, to express one's thoughts clearly, to concentrate; 2) ability to analyse; 3) ability to put into effect the principles learned, to compose. This triple power can be obtained from no source so well as from the study of mathematics. In algebra, for instance, the pupil is taught the art of thinking clearly, of concentrating. He must pay attention to details. The principles are first investigated and explained. From the principles a rule of operation is formulated. In order to apply the rules, the student must first consider the problem and discover what principles are involved. He is taught not only how to solve a problem, but must give a reason for every step he takes in the solution. Can any process, then, be better adapted to effect a methodical and systematic manner of thinking, so much desired for the study of the classics? Algebra, therefore, will be of the greatest

assistance to the student who is learning the declensions and the conjugations.

Geometry is a valuable aid in the art of analysis. A theorem is proposed for proof. The pupil must represent the theorem graphically. He ponders over the figure. What kind of a figure is it? What principles are involved? How can they be best applied? Does the graphic proof satisfy the theory proposed? Here, then, we have nothing but the process of analysis. The student, therefore, can have no better companion while he is groping along the dark paths of syntax.

In this connection it may, perhaps, not be amiss to quote a man who ranks high in both science and literature. We all have heard of Fabre's eminence in science, but not so many of us may know that he attributed much of his literary skill to geometry. He writes: "If it has ever fallen to my lot to write a page or two which the reader has run over without excessive fatigue, I owe it, in greater part, to geometry, that wonderful teacher of the art of directing one's thought. True, it does not bestow imagination, a delicate flower blossoming, none knows how, and unable to thrive on every soil; but it arranges what is confused, throws out the dense, calms the tumultuous, filters the muddy, and gives lucidity, a superior product, to all the tropes of rhetoric. Yes, as a toiler with the pen, I owe much to it."

Finally, in trigonometry we find an excellent training in the art of synthesis. Here algebra and geometry unite for a practical purpose. The figures of geometry are brought together in beautiful harmony; their relations to each other are thoroughly studied. These relations reduced to algebric equations make it possible for us to overcome the greatest difficulties of mensuration. What is the effect on the mind? An ability to use the tools of whose existence we have learned; a power to erect a structure of harmonic beauty, which is but the art of composition, of synthesis. There can be no better guide, therefore, than trigonometry for indicating the architectonic beauties of literary monuments.

Too much stress can not be placed on this coördination of mathematics with the classics. Especially is this true in regard to the study of the classic languages through the medium of the English tongue. One can more easily master a classical language through the medium of such methodical tongues as the German or any of the Latin languages, because the latter are built upon a systematic structure of grammar similar to the classical. But studying the Latin through the English language is a more difficult undertaking since in the English less heed is taken of the little grammar. This deficiency of methodical and systematical thought in the mind of the English aspirant for classical lore is remedied by a familiarity with mathematics.

What more intimate and pleasant relations could exist between two branches of knowledge? The one, mathematics, tills the virginal soil of the mind, that the flowers, the classics, may bloom with greater beauty and magnificence.

Were this assistance that mathematics gives to the student of the classics, the only benefit to be derived from its study, the curriculum in the preparatory seminary would not be complete without it. However, there are other effects produced by this often misunderstood and little appreciated branch, that render its place in the course of study not only useful but indispensable.

It may be granted that in days of yore when the principal concern

of the priest was the administration of the sacraments and the building of churches and schools, a bit of arithmetic was sufficient. Still I believe the churches he built would be more worthy houses of God, had he been blessed with a knowledge of higher mathematics. But, aside from this, the modern world expects the priest to be not only the man of God but also the scholar. True scholarship, however, is nothing else than intellectual culture of a high order. Culture comes from the Latin "colere," which means to work by plowing, fertilizing, sowing, and reaping. Applied to the mind mathematics fulfills every jot of this definition. By the concentration, intense application, and unswerving perseverance demanded of the student of mathematics, the mind is tilled, enriched, improved with systematic methods, and finally yields a harvest of good qualities otherwise not so easy of attainment. These qualities were so clearly set forth and definitely proved as resulting from the study of mathematics by Father Boniface, that it is unnecessary to go over the same ground here.

Permit me, nevertheless, to lay special stress upon two qualities, the lack of which is the source of many evils of modern society, namely, sound judgment and perseverance. The modern tendency is for speed, action with little or no consideration, and, if the end is not accomplished "to throw up the sponge." Mathematics, however, teaches us to deliberate and then to act; and, if we do not succed, to try, and try again. May we not, therefore, venture to say that mathematics will train our students to be less rash in judgment and more persevering in virtue?

To conclude. Mathematics is an aid to the study of the classics; it is an important factor in mental culture; it assists the teacher in forming the character of the young. Hence we ask for it not a minimum of consideration but a place of honor in the curriculum of our preparatory seminaries. Without mathematics we can train boys to become good priests, good men of God, good scholars; but better priests, better men of God, better scholars can be produced with mathematics in the course.

Pardon my youthful audacity in addressing this gathering of sages. I am sure, however, that you may atribute your success, in some degree, to the study of mathematics.

REPORT OF THE COMMITTEE ON THE SCIENCE COURSE

THE Committee instructed by the Conference to consider the question of the distribution and correlation of Mathematics and the Natural Sciences in the Departments of the Classics and of Philosophy, and to revise and amplify, in accordance with Can. 1364, par. 3, of the new Code of Canon Law, the program outlined at the First Franciscan Educational Conference in 1919, unanimously agrees to propose the following schedule as a guide for our institutions of learning.

Suggested Course of Study

I. The study of Mathematics should comprise Algebra, Plane and Solid Geometry, and Trigonometry.

a) The study of Algebra should have an aggregate of eight to ten weekly periods distributed over the first two or three years of the Classical Course.

b) The study of Plane and Solid Geometry should comprise, in the aggregate, six to eight weekly periods distributed over the two following years.

c) The study of Trigonometry should claim two or three periods per week in the last year of the Classical Department.

II. The study of the Natural Sciences should embrace Botany, Zoölogy, Physical Geography, and Physics in the Classical Department; and Chemistry, Geology, Astronomy, and Biology in the Philosophical Department.

a) Descriptive Botany, Zoölogy, and Physical Geography should cover two weekly periods during the first three years of the Classical Department.

b) The course of Physics should comprise, in the aggregate, four to six weekly periods in the last two or three years of the same Department.

c) To the study of Chemistry should be given five weekly periods in the first semester of the first year of Philosophy; whilst in the second semester three periods should be allotted to Chemistry, and two periods to Geology and Astronomy.

d) Finally to Biology five weekly periods should be assigned in the second year of the Department of Philosophy.

Respectfully submitted.

Fr. Joseph F. Rhode, O. F. M.
Chairman.

After the report had been received by the Conference, the President asked the Chairman to explain the findings of the Committee to the Conference. Fr. Joseph replied:

Our Committee was charged to revise and amplify the program for the study of the Sciences which had been adopted at the First Conference in 1919. Careful examination showed that the course of Sciences as outlined four years ago had on the whole been found eminently practical and had been productive of very satisfactory results wherever it had been carried through during this period. Hence the Committee agreed that the program should be left substantially intact and that only such changes should be recommended as would be necessary in order to meet the different needs of the various Franciscan Provinces now happily represented in the Educational Conference.

Course Meets all Needs

The discussion among the members of the Committee revealed the fact that, especially in the Classical Department, there is a great variety of system as regards the study of Mathematics and the Sciences, owing to the greatly different conditions of our Colleges and Preparatory Seminaries individually. And as in the Department of Philosophy the program of 1919 provides for a double plan, as the course of the Sciences in Philosophy embraces either two years or only one year, respectively, a similar latitude of program would seem to be appropriate for the study of Sciences in the Classical Department also.

As you know, in some of our Preparatory Seminaries the course embraces six, in others only five years; the entrance requirements are not uniformly established; the Sciences in some institutions are spread out over all the years of the Classical course, in others they are compressed into the higher grades of the College, whilst some educators would have the study of Sciences relegated entirely to the Department of Philosophy. Then again one or the other of our Preparatory Seminaries being an institution open to ecclesiastical students in general, is compelled in consequence to adopt the plan of studies which is generally followed by other Colleges in teaching the Sciences to the students of the classical course.

After the Committee had heard the detailed explanation of the different systems used in the various Provinces and had realized the difficulty, if not the impossibility, of laying down

a uniform program that would be acceptable to all the Provinces, the Chairman proposed that, instead of a rigid and inflexible schedule, a program be elaborated which, though substantially the same for all, would nevertheless be sufficiently elastic to be adaptable to the individual needs and usages of each Province; thus the Conference by adopting such a program might "agree on the minimum and suggest the maximum" for the single branches of the Sciences in our curriculum. Accordingly the Committee after long and fruitful discussions unanimously agreed to the program as it is contained in the report I just read to the Conference.

Mathematics

The first point to be settled, however, was whether the study of Mathematics should form a part of our deliberations and report, or not. We know that the term Sciences is used differently by different scholars and educators, some excluding Mathematics from the domain of the Sciences, others including it and even assigning a very prominent place among the pure Sciences to "the Science of quantity."

Waiving the question as to the more correct use of the term Sciences, the Committee held that it was empowered, and therefore in duty bound, to report on the Sciences in the wider sense, including Mathematics, because the Committee had been instructed to consider "the relation and proper proportion between the study of the Classics and that of the Sciences in our curriculum," whence it would appear that Mathematics falls under the wider term Sciences as contrasted with the Classics (and other language study) in our program of studies. We, therefore, introduced both terms into our report on the "Distribution and correlation of *Mathematics* and the *Natural Sciences* in the Department of the Classics and of Philosophy," and accordingly divided our report into two parts, one dealing with the study of Mathematics, the other with that of the Natural Sciences both in the Classical and in the Philosophical Departments.

Regarding the study of Mathematics, the Committee holds that this study should comprise Algebra, Plane and Solid Geometry, and also Trigonometry, since this is necessary for the proper understanding of Physics and Astronomy and should, therefore, not be omitted. Calculus, however, and other Mathematics were excluded from the curriculum as not necessary for our purposes; and Arithmetic is supposed to have been finished

in the elementary schools and consequently does not appear on the program of the Committee.

The course of Mathematics should be completed in the Classical Department, before the Novitiate. For, although good reasons may be alleged for postponing Mathematics until the student enters upon Philosophy, nevertheless on practical grounds at least it does not seem advisable to make such a radical change in our College program. It will always happen that a good number of our candidates change their mind during the years of preparatory study and go to other Colleges to continue their education for the secular priesthood or secular professions. Now such students would be all too seriously handicapped in their work, if our College curriculum included no study of Mathematics whatever or only a very elementary course. For the same practical or, if you wish, charitable reason principally, it was deemed more advisable to distribute the different branches of Science over the five or six years of the Classical Department, than to concentrate all the Sciences into the last years of the College course, though this would be probably a more desirable and effective arrangement. Accordingly we recommend that Algebra be taken during the first two or, in a six years' course, the first three years of the Classical Department, Geometry during the two following years, and Trigonometry in the last year of the College curriculum.

As to the number of periods to be assigned to the single branches, the Committee holds that a total of eight weekly periods throughout one year is sufficient for the study of Algebra, and a total of ten periods should constitute the maximum. We have used the expression, "eight to ten weekly periods *in the aggregate,*" because it must be left to the single Provinces or Colleges to determine how many of these weekly periods should be taken in the first, how many in the second or the third year of the course, respectively; but if the number of periods allotted to these several years were all crowded into one year, their aggregate or total should not be less than eight nor more than ten periods per week.

Similarly Plain and Solid Geometry should be taken during the two following years, that is to say, in the third and fourth, or in the fourth and fifth year of the College, respectively; and the weekly periods should be so divided over these two years that, if they were all assigned to one year only, their number would not be less than six—because so many periods

are necessary to cover the matter in Plane and Solid Geometry satisfactorily—nor more than eight, lest the proper proportion between the study of Mathematics and that of the Classics be lost in the College curriculum.

Finally, according to the Committee's opinion, Trigonometry should be taught in two or three periods per week during the last year, *i. e.*, the fifth or sixth year, respectively, of the Classical Department.

Natural Sciences

Concerning the study of the Natural Sciences properly so called, the Committee endorses the stand taken by the Conference in 1919, *viz.*, that a judicious choice among the numerous branches of the Natural Sciences must be made to prevent an unfair encroachment of the latter on the time required for the proper study of the Classics and of Philosophy in their respective Department. We, therefore, repeat what was stated in the resolutions of the First Conference, *viz.*, that Botany, Zoölogy, Physical Geography, and Physics should be taught in the Classical Department; Chemistry, Geology, Astronomy and Biology in the Philosophical Department.

The Descriptive Sciences of Botany, Zoölogy and Physical Geography — in the order named — should claim two weekly periods during the first three years of the College course; and special stress should be laid on the development of the power of observation in the students. Let me add that a brief survey of Anthropology might also be made to advantage in this connection. Mineralogy, however, was excluded from the program deliberately, because the essentials of that Science will recur in the study of Geology in the Philosophical Department.

The study of Physics, which might well be taken up in Philosophy, was retained in the Classical Department for this reason also, lest our curriculum differ too widely from the program followed in secular Colleges, to the detriment of such of our young men as during their years of study might leave the Preparatory Seminary for some other Institution. An average of two weekly periods during the fourth and fifth year of the Classical Department the Committee considers the minimum to cover the essentials; if, however, an aggregate of six weekly periods is assigned to the course, either by increasing the number of weekly periods from two to three in the fourth and fifth class, or by adding two periods in the

sixth, the teacher will find ample time to explain all the important phenomena in General and Special Physics.

In the Philosophical Department it is chiefly Chemistry and Biology among the Natural Sciences that must engage the attention of our students; not indeed as if a professional and complete laboratory course would have to be conducted in these branches of Science, but that they should be taught in so thorough and comprehensive a manner as to furnish our Clerics a solid scientific basis for a better and more correct understanding of the manifold problems of Cosmology and Psychology.

By keeping the entire course of Physics in the College curriculum and reserving Chemistry for the Philosophical Department another advantage is obtained with regard to the material equipment for our courses in Science. Physics and Chemistry require a distinct laboratory each; whereas the biological laboratory required in the Philosophical Department can easily be made to serve for the experiments in Chemistry also.

Chemistry, then, should be taken in the first year of Philosophy, and five weekly periods would seem to be the right quota, in the opinion of the Committee, for sufficient treatment of the essentials of Inorganic and Organic Chemistry; and more than five periods per week can not be allotted to the Sciences in the Philosophical Department, as was determined at the First Conference four years ago. In the second semester, however, we have recommended a reduction from five to three weekly periods in Chemistry, because two periods will be required for the elements of Geology and Astronomy, which should be studied before Cosmology is taken in Philosophy.

Moreover, the Committee believes that the Sciences should not all be crowded into the first year of the Philosophical course, but should be spread out over two years; on the other hand, even where the three years' course of Philosophy has been introduced, the study of the Natural Sciences should be completed in the second year of the course and not be extended into the third year.

Accordingly we again endorse the arrangement recommended in the program of the First Conference, *viz.*, that Biology (including Physiology) be taught in the second year of Philosophy in order to prepare our students to grasp more thoroughly the complex problems of Psychology; five weekly

periods would seem to be sufficient for a fairly good theoretical and laboratory course in Biology.

Against Weekly Period in Latin and Greek

In conclusion I wish to add that, in the course of its deliberations the Committee found it to be the general opinion of the Lectors concerned, that the one weekly period of Latin and of Greek, which was introduced into the schedule of studies of the Philosophical Department at the First Conference in 1919, is of so little practical use as not to warrant its retention on the program, especially not in those Provinces where a six years' course in the Classics is given in the College.

DISCUSSION

FR. CONRAD REISCH:—The question may be raised whether by our course of study the students will not become too much interested in natural science and in consequence neglect philosophy. I think the Conference will welcome any opinion based on experience. I have been teaching philosophy to such students as were also taking natural science. During the past year I took logic and ontology with a class that was also occupied with chemistry. Now I do not find that such study is detrimental to philosophy or that it destroys interest in the more abstract subject. Natural science, I find, does not prevent students from properly appreciating the great problems of philosophy.

Too Much Science in Our Course of Study?

Some difficulty might arise about the time devoted to the various studies. What is required by our course of study in the line of natural science does not seem to involve an undue amount of time for this subject. It might happen, however, that tasks be imposed (research work, special papers) to such an extent that they would encroach on the time required for the proper study of philosophy. To guard against such an unfavorable development, it is advisable that the Lectors confer with one another at times. If the Lectors of different Provinces can meet for a national conference, surely the Lectors of the same house can at times confer together and try to adjust their endeavors so as best to secure the general progress of their scholars.

FR. SIMON:—I for one am glad to confess that I have learned much during this meeting about the pressing need of greater interest in the sciences. I admit that the Friars in Canada should take more kindly to the sciences. Though most of our Fathers have the degree of Bachelor in Science from either Laval or Montreal University based upon a thorough course in mathematics (including trigonometry), zoology, botany, mineralogy, physiology, astronomy, chemistry, and physics, their interest in the sciences seems to wane during their priestly life.

Objections to Science Teaching

This apathy towards the sciences may be traced to different causes. Let me indicate some of them. There is, first of all, the religious background which induces the French Catholics to hold the natural sciences of less import than the supernatural or even the moral sciences. Veiullot was the standard-bearer of the French Catholics in the 19th century, and he voices (in his "P. de Rome," II, p. 344) what seems to me the characteristic French attitude in respect of the sciences: "Rome is the intellectual centre of the world. I know that the specialists, chemists, mathematicians, physicians, writers, and other great authorities of material things are elsewhere, i. e., in the vicinity of the great industries that employ them. If it is a question of opening a factory, of outlining a prospectus, of backing a business undertaking, of planning the conquest or the robbery of new territory, certainly the men are not here. But business transactions are made by men different from those who create ideas. The creators of ideas are here, or from here, or they come here. The intellectuals of Europe that see Rome in the course of a year, surpass in number and importance all that visit any other Capital. Real importance is not measured by the noise one can make or the titles one can flaunt. A Bishop, even though little known, exerts upon the affairs of this world a stronger influence than is within the power of the tongue and pen of many orators and academicians though they be widely known."

Again, the French can not believe that science will ever solve the problems that, after all, matter most to man. In the "Atlantic Monthly," of March, 1915, I find this truth happily expressed: "Science, which has been the great intellectual adventure of the last century—to what has it led us? Only again to that edge of the unknown, where we confront the infinite. It has not gained by one hair's breadth upon the encompassing mystery of our lives." It is in this sense that we speak with Brunetiere of the "bankruptcy of science," or with Dubois-Reymond, "Ignoramus et ignorabimus." With all the vagaries of science, we feel that Joubert was profoundly right when he said: "Where there is no faith, we can not believe anything for certain."

Then it is also said that in these days of vastly increased stores of knowledge it were vain to aspire after encyclopedic or universal learning. No scholar would venture to-day to boast as did Pico della Mirandola that he knew everything "de omni re scibili et de quibusdam aliis." Even Leibnitz was considered to be jesting when he pretended to be ignorant of nothing.

The clergy who must be specialists in the science of the supernatural, may, then, be pardoned (so the argument runs) for being ignorant of the sciences of nature. In our clerical seminaries the latter are consistently called "the little sciences." One professor of philosophy even advised his students: "Give your time to philosophy, and your time will be well spent; the priest has no need of all that rubbish of the sciences." To such educators of the clergy the study of science seems much like dancing. "Dancing," they say, "makes for graceful walking, and if life were long enough we might therefore employ a dancing master for our prospective priests." In fact, the sciences are said to deal with subjects that concern the priest very little. Cardinal Newman writes pertinently: "Not till the State is blamed for not making saints, may it be fairly laid to the fault of the Church that she can not invent a steam engine or construct a tariff." Even reasons of health have been alleged against the study of the

sciences for it is asserted that if we do not draw the line somewhere, we shall make nervous wrecks of all our students.

The intensive study of the sciences has also been decried as a characteristic of the schools in the United States, and my countrymen have been warned not to imitate these too closely. At the Commencement Exercises of McGill University held on May 29, 1923, Professor Stephen Leacock was roundly applauded by his audience of 3,000 for the following statement: "In the Province of Quebec we have the happiness of being blessed with two languages and two different cultures. I think we should do well to work in our own rich field, and not to amalgamate in educational matters with the rest of America."

But the warning of Leacock notwithstanding, I believe that the Canadian Friars must take a deeper interest in the sciences. Enough has been said at the present Meeting to establish the fact that they will thereby be preserving splendid Franciscan traditions and also serving the interests of the Church.

Science Study and Foreign Missions

However, there remains one particular reason that will urge the Canadian Friars, and I believe also the American Friars to cultivate the sciences more intensively, namely, the needs of the Foreign Missions. Our Province has opened a Mission College at Sorel to train missionaries for the Far East. Six of our Friars left for Japan during the past few months, and we trust that they will be followed by many more in the years to come. But a knowledge of the sciences is an integral part of the equipment of the missionary. The history of the Missions in the Far East is a telling argument for the study of the sciences.

Rohrbacher ("History of the Church," Vol. II, p. 317) gives several instances of the spiritual successes scored by the Jesuit missionaries because of their scientific attainments. After the death of Father Ricci, in 1610, the work of the Missions was largely interrupted by revolutions. But when the Emperor Cunchi, a Tartar, ascended the throne he named Father Adam Schall president of the tribunal of mathematics. But upon the death of this Emperor, the Christian religion was exposed to new persecutions during the minority of Cunchi's son, Can-Hi. However, it was the scientific attainments of the missionaries that restored them to power and influence. For when the young prince became of age it was found that the calendar was in utter confusion, and recourse was had to Father Verbiest who was forthwith appointed successor to Father Adam Schall, the latter having died in 1666.

Father Verbiest promptly availed himself of the golden opportunity and called from Paris the learned Jesuits who were to carry the doctrine of Christ and the glory of the French name into the heart of Asia. The Jesuit who left for China, armed himself with the cross, the telescope, and the compass. He appeared at the court of Pekin equipped with the urbanity of the court of Louis XIV. and fortified with the mastery of the arts and sciences. By unfurling charts, revolving globes, and tracing planets he taught the bewildered mandarins both the true course of the stars and the true name of Him Who directs them; and he dissipated the errors in physics only to attack the lapses in morals. Thus science was the avenue by which he led the Orientals to the knowledge of the true God and His eternal law.

May we not, then, hope that the same method of evangelizing the heathen will succeed in the present age? Pope Pius XI. recently

made a personal gift of 50,000 lire to prevent the suspension of "Anthropos," a periodical devoted to reporting the scientific researches conducted by missionaries. On the occasion of making the gift, His Holiness explained: "It is very necessary in this new missionary era that we enroll science in the ranks of the missionaries, and that science should be cultivated in the missions." It is with a similar purpose in view that the Pope is planning a great Mission and Ethnographic Exposition to be held in Rome in 1925.

So it would seem that in furthering the study of the sciences we are serving a very holy cause and following a most august example.

EQUIPMENT AND RESEARCH WORK IN THE SCIENCES

Fr. Aloysius Fromm, O. F. M., Ph. D.

SCIENTIFIC equipment and research work is a subject so vast that it does not lend itself very well to an exhaustive treatment within the limits of the time assigned to me. Besides the difficulties arising from the too general term "Sciences," there are others which spring from the different purposes we have in view in the teaching of the natural sciences in our schools. Thus the scientific training of the future pastor of souls will necessarily differ, not only in quantity, but also in kind, from that required of the candidate of the scientific or medical profession. To escape, to some extent, these difficulties, I shall limit my remarks to the sciences of physics, chemistry and biology, keeping in mind principally the needs of our own schools and the training of our clerics. It should not be difficult to make the necessary applications to the science courses in the standard colleges. My remarks about the equipment for the study of physics are not based on personal experience, and for them I beg the indulgence of my confrères who have specialized along those lines.

The subject matter naturally divides itself into three parts:

(1) laboratories and their equipment;
(2) textbooks and reference works;
(3) research work in our seminaries and clericates.

Rooms

If available, the rooms for science should include laboratory, class room, and stockroom for each department. In many cases, however, and for smaller classes suitable combinations are readily made. Thus one room could serve at the same time as laboratory and class conference room for physics, a second one for biology and chemistry, and a third, if sufficiently large, as a common stockroom. The latter should be located between the laboratories and easily accesible, because efficiency in class management and also economy require that all apparatus be stored as near as possible to the places where it is used, to avoid unnecessary delays and breakage. Delicate apparatus, whether for the physical, or

chemical, or biological sciences, should never be kept in the chemistry laboratory, where the corrosive fumes would soon ruin it. A small workshop, where apparatus can be cleaned and repaired, can readily be found in most of our monasteries. A photographic darkroom will be a valuable addition to the biological laboratory. Besides these, every science teacher should have his own private laboratory for research work, where he and his materials are undisturbed. A small greenhouse is a valuable aid to the practical study of botany and can often be arranged at a very small cost.

Before building or planning a science school, it is advisable to inspect some modern up-to-date schools. The science teacher should be consulted, when plans are being made as to the best arrangement of the rooms. The physics laboratory should be located on the south side of the building, preferably on the south-east corner, to insure direct sunlight which is necessary for many experiments in physics. The biological laboratory is best located on the north side, as the light of the northern sky is the best for microscopic work. An ideal room for biology would be the north-east corner, where growing plants, of which there should always be a goodly number, may receive the morning sun, while the microscopes could still be lighted from the northern sky. On account of the disagreeable gases and fumes, the chemical laboratory finds the best place in the top floor of the building, though this will complicate the plumbing work.

If rooms must be fitted up for instruction in the sciences after the building is completed, the disposition of the equipment must, of course, be adapted to fit the rooms as they are, and it is often difficult to devise a thoroughly satisfactory arrangement. It is best to determine as exactly as possible what fixtures and furniture are needed to carry on the work, and the amount of floor space needed for each, and to map out in advance the plan for the arrangement.

When electric light is available it should be furnished and should be generously provided for, to avoid wholesale impairment of the eyes. Suitable wiring, switches, and openings should be provided for supplying current of electricity for the experiments where it is needed. In addition to the provisions for heating, ventilating and lighting, the science rooms should be provided with running water (both hot and cold) and with

gas. In physics and chemistry both water and gas must be distributed to each student at the working table; for biology it should be provided at the demonstration table, and there should be several sinks and gas openings at other points according to the needs of the students.

The windows of the laboratories exposed to direct sunlight should be equipped with shades of translucent material either white or grey or buff. Arrangements should be made for darkening the rooms for stereopticon work and other experiments. For biology the window panes should be large, preferably one large plate glass for each half of the window, thus eliminating the cross bars, whose shadows interfere so easily with microscopic study.

The furniture of the laboratory includes tables, chairs, cabinets, cases, shelves, etc.

The minimum table space for each student should be thirty-six by eighteen inches. Four feet is the best width for the tables.

Tables

For biology, work tables having the top in the form of an elongate isosceles trapezoid have many advantages. When placed with their wider ends towards the windows, the arrangement secures the nearest approach to an equitable distribution of light. Such a table, about nine feet long and ends respectively four and a half and two and a half feet wide, will seat seven students. These tables should be simple, made of the best seasoned lumber, with straight or slightly tapering legs, and have composite non-warping tops of hard pine or maple not less than one and a half inches thick. The tops should not be varnished or polished, but should have a paraffin dressing ironed into them. Drawers are not recommended for these tables.

For physics similar tables, but of rectangular shape should be used. A table whose dimensions are four by twelve feet, easily accomodates eight students. No drawers are necessary for these tables, but each student should have his own water and gas supply. Physics and biology tables can be made according to specifications by any local carpenter, but one should insist on only the best lumber being used to avoid warping and cracking.

Chemistry tables are more economically purchased from a reliable firm, such as the Kewaunee Mfg. Co., Kewaunee, Wis.

Those tables are to be preferred where all the fixtures for water, gas, and drain are easily accessible. The water trough should be in the center and slope to one end where the sink is attached. The Kewaunee tables are generally fitted with toe space on the working sides. A desk so equipped has all the advantages of the so-called overhang style, with the added advantage of deeper cupboard space.

In every science room a demonstration table with a good-sized sink, with running water (cold as well as hot if possible), with several gas openings and electric connections is indispensable. The best dimensions are perhaps: two and a half feet wide, three to three and a half feet high, and from eight to ten feet long. It should be roomy enough to accomodate all the apparatus necessary for the demonstrations to be made during a period, to avoid loss of time in getting and replacing the apparatus. The demonstration table should contain a number of drawers and lockers of convenient sizes for receiving various small articles and supplies that are constantly needed and should always be on hand.

Chairs

As most of the work in physics and chemistry is done standing, no chairs are required. For biology the simple three-legged stools are perhaps the best. Adjustable "piano stools" wear out too rapidly and are too cumbersome. Stools varying in height, supplemented by small blocks which can easily be adjusted to the legs to increase the height of the chair, will give satisfaction. But care should be taken to make the adjustments so that the students are seated comfortably. If the laboratory serves at the same time as lecture or recitation room, chairs with an arm rest take up least space. Laboratory chairs can often be bought at a real bargain in second-hand furniture stores.

Cases, Cabinets, Shelves

The laboratory should contain a number of cases of varying depths to hold all the apparatus. Cases for physical apparatus should be about eighteen inches deep with adjustable shelves and glass doors. Sliding doors may be used where there is insufficient space for swinging doors, though the latter close better and are more dustproof. The joints around the doors should be fitted with strips of felt to keep out the dust. As most science apparatus is rather expensive and delicate, much care should be

taken to protect it in every way. Microscopes, telescopes, and other optical instruments as well as all rubber goods are best preserved in cases without glass doors. Chemicals, reagents, etc., may be kept on open shelves. All shelves should be adjustable, and their depth should depend upon the apparatus they are to hold. In this way much space can be economized.

There should also be cases for wall maps, charts, models, etc. Whether spring rollers or ordinary rollers are preferable for wall maps, is a matter of choice. The former are more expensive; the latter serve the purpose perhaps equally well. By tacking or gluing a piece of enameled cloth to the bottom of each map, so that it will cover the map and keep the dust out, a very serviceable apparatus is obtained. But all maps should be kept in dustproof cases. Instead of shelves, these cases are best supplied with horizontal rods, bent slightly at right angles in front, and screwed to the back of the case.

Pictures, microscopic slides, lantern slides, etc., are best kept in the teacher's private laboratory.

Apparatus

The best plan for providing an outfit for any science is first to select the textbook and the laboratory guide (manual) that are to be used in the course, then to go through them carefully and decide on the demonstrations and laboratory experiments that are to be made. Some of those in the books will probably be omitted, and others not in them will be added. When this has been done, the list of the equipment necessary for the teacher and the pupils can be made out.

Biology

In the study of biology, the instruments needed by the individual student are for the most part few and relatively simple and inexpensive. A good hand or pocket lens (4 to 9, or 6 to 12), one or two scalpels, a pair of forceps, and two dissecting needles, constitute the minimum for botany and are sufficient for the general work in zoölogy. Each student should have his own set and be responsible for it.

The compound microscope is indispensable in the modern biological laboratory. A standard form of the instrument, with milled heads for coarse and fine adjustments, iris diaphragm, two objectives (16 m. m. and 4 m. m.) and two eyepieces (4 and 8) should be purchased. Beware of cheap imitations. Reliable firms in this country are the Bausch and Lomb Optical Co., of Rochester, N. Y., and the Spencer Lens

Co., Buffalo, N. Y. Favorite foreign makers are Zeiss (Jena), Leitz and Seibert (Wetzlar), and Winkel (Goettingen). The ideal class equipment would include one microscope for each pupil, but the work can be efficiently carried out with one microscope for each group of three or four students. There should be at least one instrument which is equipped with a substage condenser, an oil immersion and other accessories for advanced work by the teacher and for occasional demonstrations. To this can be added in the course of time a camera lucida for drawing and a mechanical stage. Several dissecting microscopes should be included in the biological equipment.

If the teacher has had training in the laboratory technique of sectioning, staining, and mounting materials for permanent slides he should provide for a minimum outfit of paraffin oven, a rotary or sliding microtome, section razor with strop, and a liberal supply of slides and cover glasses, and the necessary stains, media, and chemicals. It is of great importance for the school to accumulate such slides for demonstration.

The general apparatus will include dissecting pans, specimen jars, several pairs of bone forceps and cartilage knives, a bone saw, test tubes, pipettes, medicine droppers, Petri dishes, glass and rubber tubing, and chemicals. All these are best purchased from the regular dealers.

Visual Aids in the Study of the Sciences

Beside abundant laboratory materials both living and preserved, the laboratory should contain a choice selection of charts to serve as visual aids in botany, zoölogy, and human physiology. Plastic models are to be preferred if they can be had, and the teacher should gradually acquire a fairly complete set of these. For the study of human physiology these models should include torso, head and brain, heart and lungs, larynx, eye, and ear. Such models are being made in this country of a special composition by the W. W. Welch Scientific Company, Chicago. Some teachers prefer the lighter, non-breakable models of papier-maché. The latter have the advantage of being made in sections and are thus readily taken apart.

Beautiful and ingenious animal and plant preparations in great variety are on the market and can be made use of in demonstrating. They are fully described in the Kny and Sherer Catalog. A good rule in this connection is, "After

getting a start do not buy anything that you or your pupils can make."

Collections of typical lantern slides are sold by the dealers, showing plant and animal tissues, parts of smaller insects, bacteria and the like, and a judicious selection is a good investment. If the school has a stereopticon — and every school should have one — the lantern slides can easily replace the wall charts, being less expensive and easier to store and to handle. Such slides are not only useful in teaching, but are also a great aid in creating community interest by making possible the popular illustrated lecture. Microscopic slides in great variety can be made by the teacher and his pupils, and will always repay the labor expended.

The biology laboratory should by all means contain some living plants and animals. A small aquarium should therefore be installed, and a small greenhouse is a desideratum.

Physics

As in the case of other science subjects, the equipment for physics should be as good and generous as the school can afford. Where economy is necessary, the principle should be to eliminate from the list those articles that are most expensive and least used. The thoroughly competent teacher, moreover, will recognize that a workbench with a minimum outfit of hand tools for working in wood and in metal, and a judicious assortment of supplies in the form of planed boards and strips of wood, nails, brads, screws, wire, sheet metal, solder and soldering tools, glass and rubber tubing, corks and rubber stoppers, constitute an important part of the fundamental equipment of all science work and an indispensable means of supplementing and keeping in order the equipment of a school. If the teacher is given the necessary time, and can interest and train some of the students to help him, there is almost no limit to the amount and kind of apparatus that he can improvise and make. But no matter how ingenious and industrious the teacher may be, there is always need for supplies and raw materials that must be obtained by purchase. To avoid unnecessary expense, the teacher should know what experiments are to be made during the course either by himself or by the students. This will reveal to him what apparatus is required. Some things may be bought to good advantage from local department stores or dealers in hardware and electric supplies. But the more important items of the

apparatus should be ordered from the regular apparatus dealers. Twiss, whom I am following here, suggests the following list:

Spring balances, beam balances and weights, meter sticks, wheel and axle, cars for inclined planes, dissectible Swiss clock, Hall pressure gauge, cylindrical graduates, small steam gauge for gas and water pressures, spirometer, or seven-in-one apparatus, mercury, standard barometer, air pump, Magdeburg hemispheres, "hand-glass," Florence flasks, water motor, speed indicator, stop watch.

Boilers or hypsometers for heat experiments, psychrometer, copper and aluminum wire or clippings for specific heat, Junker-calorimeter and Thorpe gauge or gas meter (for heat of combustion of gas), Bunsen burners and rubber gas tubing, thermometers, sectional model of steam engine.

Bar magnets and iron filings, small pocket compasses, D'Arsonval galvanometers, bare and cotton-covered copper and German silver or Manganin wires (for making magnet and resistance coils, etc.), double connectors, Weston voltmeters and ammeters, "St. Louis" demonstration dynamo and motor with electromagnetic field attachment.

Hand or motor rotator, siren, Galton's whistle, tuning-forks, manometric flame capsule and revolving mirror, organ pipes, set of demonstration lenses, cheap lenses for laboratory experiments (10 to 15 c. m. focal lengths), laboratory prisms, radiometer, Newton's rings, Maxwell color mixer.

Of the more expensive apparatus Twiss advises that in the course of years the following be added: The Hartl optical disc, a porte-lumière or solar projectoscope, projecting lantern for artificial radiants, the Von Nardroff color mixer, lecture table galvonometer, voltmeter and ammeter combined, Weston voltmeters and ammeters, sympathetic tuning-forks, models of ear and eye, dissectible dynamo motor, induction coil, static machine, wireless telegraph apparatus, Röntgen ray and other vacuum tubes, a mercury rectifier or a "Nodon Valve."

When the list of apparatus is complete, copies of it may be sent to several dealers, who will return it with the prices filled out in detail, and a statement of the total cost at which

How to Order

they can furnish the entire order. The prices of reliable dealers on standard types of apparatus are in most cases much the same. They usually allow a discount to schools. It is not wise to try to beat them down through competitive bidding. It is far better to pay their prices, letting them understand that quality and reliability are preferred to cheapness, and that they are expected to stand behind every piece with their honor and good name. The best houses do this and are perfectly willing to take back any piece that is not satisfactory. A discriminating teacher will not award the entire order to any one dealer.

Chemistry

The most expensive item of the equipment for chemistry is the furniture and plumbing, but if once installed, it is a good investment for years to come. Most of the chemical glassware and most of the supplies are relatively inexpensive. It would be useless to give a complete list of chemicals needed for a course. The needs must be determined by the experiments given and the number of pupils in the class. The substances should be of the chemically pure quality rather than the commercial; in some cases the U. S. P. quality is equally good and generally less expensive. It seldom pays to buy from local drug dealers. One can buy almost all chemicals cheaper and of better quality from reliable chemical supply houses. Chemicals that keep are best ordered in packages of from one to five pounds. Nearly all the chemistries or the handbooks that accompany them, as well as the catalogs of many firms give lists of the chemicals and the apparatus needed. The teacher should make out his lists with this as a guide, making proper allowance for the number of pupils.

Deliquescent or efflorescent salts should be kept in tightly corked bottles. The corks should be soaked in melted paraffin and after opening should be resealed with a bit of paraffin. Rubber goods of all kinds, and chemicals that are affected by light should be kept in the dark. The stoppers of the reagent bottles containing Na_2CO_3, NaOH, and KOH, should be dipped in melted paraffin, or rubber stoppers should be substituted for them.

Each individual student must be supplied with a certain irreducible minimum of apparatus, including a Bunsen burner with 18 inches of rubber tubing; a ring stand and several

clamps; a sand bath; a test tube rack with six test tubs; a test tube holder and a test tube cleaner; a small watchglass; a 2½-inch funnel; a 3-inch porcelain evaporating dish; glass stirring rod; small porcelain crucible with cover; a clay-covered wire triangle to support the crucible, and a pair of crucible tongs; two hard glass tubes; four 8-ounce salt-mouth bottles for collecting and holding gases; small squares of glass for covering the bottles; a file; rubber and glass tubing, and a package of two-inch filter paper.

Besides these the general apparatus should include several burettes, beakers, flasks, thistle tubes, graduates, mortars and pestles, several hand balances, and a small platinum wire for flame tests. Of the more expensive items to be acquired as time goes by are a water still, and at least one fairly accurate chemical balance. The laboratory should also have a small fume hood for the removal of obnoxious gases. This can be made according to specifications at a very low price.

In our schools it may be advisable to have two students work together. This will reduce the amount of apparatus reagents necessary for the experiment. Further saving is achieved by demonstrating the experiments in which the more expensive chemicals are needed, and above all by a strict supervision which prevents waste of chemicals, breakage of glass apparatus and too rapid deterioration of all other apparatus. The teacher should insist on cleanliness, orderliness, and careful handling of all, especially the more expensive apparatus. In this way, the apparatus once installed can be used for many years, and the yearly expense of the laboratory will be reduced to a very moderate amount.

Reference Works and Text Books

I come to the perplexing question of textbooks. Personally, I do not attach overmuch importance to this subject. While a good textbook is a valuable aid to the teacher and his pupils, it should not be indispensable, and a competent teacher will use his text rather as a guide than submit to it as a dictator. In the field of science particularly, there is such a divergence of opinion as to what is essential and what is merely advisable, that a large measure of freedom should be left to the teacher and to his class. I think we should recognize the difference in this respect between the theological and philosophical disciplines on the one hand, and the science courses on the

other. In the former there is a definite subject matter which has become traditional, and in which the teacher's choice is naturally limited, while in the sciences much depends upon the purpose one has in view. In theological and philosophical matters, moreover, attention must begiven to the wording, the definitions, the exact form of the arguments, etc. The use of Latin in teaching these subjects, also, makes a textbook much more necessary. In the sciences, many of these considerations fall. These disciplines are moreover largely experimental, so that the use of a textbook is not an absolute necessity.

Still, there is a large supply of them on the market, and it should not be too difficult to make a satisfactory choice. A question that will always confront us, is whether we wish to choose a so-called college text or a high school text. The former are frequently too extensive, the latter too elementary, although in some cases the happy middle course seems to have been chosen. The choice will depend much on whether the teacher prefers to retrench or to amplify his text. I have tried both kinds of books and find them equally serviceable, although with an average class perhaps a short text with the essentials is to be preferred. Especially with regard to the laboratory manual, I think the teacher should have much liberty, and in many cases, it can be dispensed with, the teacher choosing a line of experiments suitable to illustrate and corroborate the theoretical part of his work.

Much more stress should be laid on the question of reference works. It is my opinion that in this matter we have been rather too conservative, relying mainly on this that the pupils assimilate what we give them, and being satisfied with that. But we can not close our eyes to the fact that a certain opportunity for initiative should be given the students. And I find that the average student is rather anxious to do something of himself, to work out a problem not treated in class, or to go more deeply into a subject than can be done in class. It is his own, something that he has done, and he feels proud of it. Given the opportunity the more talented students will prepare occasionally a paper or essay on some subject connected with the class work. There should, of course, be some supervision, but we should not be narrow-minded in this. For the teacher, too, a number of reference books should be at hand, and should be used freely. Would not his efficiency be much greater

if he could devote an hour or two every day to reading not only other texts, but more extensive and exhaustive treatises on the matter which he has before him? There is always the danger of the teacher's losing sight of the larger bearings of the subject matter, if engrossed in his textbook and a certain line of experiments he neglects to consult works of a more general nature, especially also such as treat of the philosophic or humanistic side of the natural sciences. Considerations such as these prompted me to include in this paper a fairly large number of reference books. The list is only a tentative one, and I would suggest that every science teacher add to it whatever he has found of interest to himself.

Passing over from these general considerations to the more definite one concerning a suitable textbook for the individual sciences, I find myself at a loss, as my own experience is limited to the biological disciplines and possibly also to chemistry. In the other fields I offer only suggestions and invite the opinions of those more competent to judge.

Biology

As our plan of studies provides for only one year's study of biology and physiology, Hunter's *Essentials of Biology,* Peabody's *Elementary Biology,* or Bigelow's *Introduction to Biology* would recommend themselves. These books cover the essentials of botany, zoölogy and human physiology. In botany I know of no better book than Coulter's *A Textbook of Botany.* In zoölogy, Hegner's *College Zoölogy* is widely used. In physiology I would recommend Davison's *Human Body and Health,* or Pearce and Macleod's *Fundamentals of Human Physiology.*

Chemistry

There is a great variety of textbooks of chemistry on the market, and it should not be difficult to find something suitable. Among the more elementary ones are: Brownlee, R. B. and Others, *First Principles of Chemistry;* McPherson and Henderson, *First Course in Chemistry;* and Alexander Smith, *Elementary Chemistry.* More advanced, and giving more attention to the theory of chemistry are: Smith, *General Chemistry for Colleges;* McPherson and Henderson, *A Course in General Chemistry;* McCoy and Terry, *Outlines of Chemistry.*

Perhaps the most widely used texts in Physics are Adam's *Physics for Secondary Schools* and Ames' *Textbook of General*

Physics

Physics. A first Course in Physics by Millikan and Gale is also recommended widely. Some teachers prefer the longer text of Henry S. Carhart, *Physics for University Students,* although it may be too extensive for our purposes. Other textbooks for the various sciences are found in the following lists.

GENERAL REFERENCE WORKS

Auerbach, F.
Die Grundbegriffe der modernen Naturlehre. Leipzig, 1917.

Braun, C.
Ueber Kosmogonie vom Standpunkte christlicher Wissenschaft. Muenster, 1906.

Faraday, M.
The Chemical History of a Candle, Ed. by William Crookes. Harpers, N. Y., 1903.

Gockel, A.
Schoepfungsgeschichtliche Theorien. Koeln, 1910.

Graetz, L.
Die Atomtheorie in ihrer neuesten Entwicklung. Stuttgart, 1919.

Hodson, F.
Broad Lines in Science Teaching. Macmillan, N. Y., 1910.

Isenkrahe, C.
Das Endliche und das Unendliche. Muenster, 1915.

Mann, C. R.
The Teaching of Physics. Macmillan, N. Y., 1912.

Mie, G.
Molekuele, Atome, Weltaether. Leipzig, 1911 (4 Aufl., Wesen der Materie, 1. Teil, 1919).

Mivart, St. George.
The Groundwork of Science. Putnam, N. Y., 1908.

Nys, D.
Cosmologie ou etude philosophique du monde inorganique. Louvain, 1906.

Ostwald, W.
Vorlesungen ueber die Naturphilosophie. Leipzig, 1905. Naturphilosophie (in "Kultur der Gegenwart") Leipzig, 1908.

Pearson, K.
The Grammar of Science. Macmillan, N. Y., 2 vols., 1915.

Perrin, J.
Die Brownische Bewegung und die wahre Existenz der Molekuele (Uebersetzt v. Donau). Dresden, 1910.

Radl, E.
Geschichte der biologischen Theorien in der Neuzeit. 1 Tl. 1913; 2. Tl. 1909, Leipzig.

Smith, A., and Hall, E. H.
The Teaching of Chemistry and Physics. Longmans, N. Y., 1913.

Vallery-Radot, R.
The Life of Pasteur, 2 vols. McClure, Phillips and Co., N. Y.

Weber, A.
Allgemeine Gesetze der Natur. (In: "Das Buch der Natur" 1). Regensburg, 1914.

Weber, A.
Chemie und Physik der Koerper (In: "Das Buch der Natur" 1) Regensburg, 1914.

Werner, A.
Neuere Anschauungen auf dem Gebiete der Chemie. Braunschweig, 1913.

Whetham, W. C. D.
Science and the Human Mind. Longmans, Green and Co., 1912.

Wright, L.
Optical Projection. Longmans, N. Y., 1901.

PHYSICS

Abraham, H.
Receuil d'Experiences Elementaires de Physique. Gauthuer-Villars. Paris, 1904, 2 vols. A complete illustrated manual of physical experiments and manipulation. Very valuable.

Duff A. Wilmer, Editor.
A Textbook of Physics. 4th ed., 1916.

Faraday, M.
Experimental Researches in Electricity. Dutton, N. Y.
Handbook of Chemistry and Physics. The Chemical Rubber Company, Cleveland, 8th ed., 1920-1921.

Kent, W.
Mechanical Engineer's Pocketbook. Wiley, N. Y., 1916.

Lincoln, J. C.
Practical Electricity. Cleveland Armature Works, Cleveland, Ohio, 1904. A simple discussion of dynamo, motor, and electric transmission arithmetic.

Lodge, Sir O. J.
Mechanics. Van Nostrand, N. Y., 1892.

Lodge, Sir O. J.
Modern Views of Electricity. Macmillan, London and N. Y., 1907.

Lodge, Sir O. J.
Signalling across Space without Wires. Van Nostrand, N. Y., 1909.

Mach, Ernst.
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Mach, Ernst.
Popular Science Lectures. Open Court Pub. Co., 1906.

Mann, C. R. and Twiss, G. R.
Physics. Rev. ed., Scott, Foresman and Co., Chicago, 1910.

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Theory of Heat. Longmans, N. Y.

Schuster, A.
The Progress of Physics during Thirty-three Years. University Press, Cambridge, Eng., 1911.

Symposium.
On the Purpose and Organization of Physics Teaching in Secondary Schools. Smith and Thurton, Chicago.

Thomson, J. J.
Electricity and Matter. Scribner, N. Y., 1904.

Tyndall, John.
Six Lectures on Light. Appleton, N. Y., 1893.

Twiss, G. R.
Laboratory Exercises in Physics. Scott, Foresman and Co., Chicago, 1906.

Watson, W.
Textbook of Physics. Longmans, N. Y., 1903.

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Baskerville, C.
Municipal Chemistry. Series of 30 lectures by experts. McGraw, N. Y., 1911.

Bauer, Hugo.
A History of Chemistry. Longmans, N. Y., 1907.

Blanchard, A. A., and Wade, G. B.
Foundations of Chemistry. American Book Co., 1914.

Bradbury, R. H.
An Inductive Chemistry. Appleton, N. Y., 1912.

Brownlee, R. B., and Others.
Practical Chemistry. Allyn and Bacon, Boston.

Brownlee, R. B.
First Principles of Chemistry. Allyn and Bacon, Boston, 1915, Rev. Ed.

Brownlee, R. B.
Chemistry of Common Things. Allyn and Bacon, Boston, 1914.

Findlay, A.
Chemistry in the Service of Man. Longmans, N. Y., 1916.

Martin, Geoffrey.
Triumphs and Wonders of Modern Chemistry. Van Nostrand, N. Y., 1911.

McPherson, W. and Henderson, W. E.
A Course in General Chemistry. Ginn, Boston, 1913.

Meade, R. K.
The Chemist's Pocket Manual. Chem. Pub. Co., Easton, Pa., 1910.

Mendeleef, D.
The Principles of Chemistry. Ed. by Greenaway. Longmans, N. Y., 1911, 2 vols.

Morgan, W. Conger, and Lyman, James, A.
Chemistry. An Elementary Textbook. Macmillan, N. Y., 1911.

Noyes, W. A.
Organic Chemistry for the Laboratory. Chem. Pub. Co., Easton, Pa., 1911.

Ostwald, Wilhelm, and Morse, H. W.
Elementary Modern Chemistry. Ginn and Co., Boston, 1909.

Rogers, A. and Aubert, A. B.
Industrial Chemistry. Van Nostrand, N. Y., 1912.

Roscoe, H. F. and Scholemer, C.
Inorganic Chemistry. Appelton, N. Y., 1908, 2 vols.

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Bernard, A.
Lecons sur les phenomenes de la vie commune aux animaux et aux vegetaux. 2 vols., Paris, 1885.

Branca, W.
Der Stand unserer Kenntnisse vom fossilen Menschen. Leipzig, 1910.

Bumueller, J.
Die Entwicklungstheorie und der Mensch. Muenchen, 1907. Die Urzeit des Menschen. Koeln, 1914.

Darwin, Charles R.
The Origin of Species. Appleton, N. Y.

Dennert, E.
Vom Sterbelager des Darwinismus. Halle, 1911.

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All Works.

Fleischman, A.
Die Deszendenstheorie. Leipzig, 1901.

Frank, S.
Die Entwicklungstheorie im Lichte der Tatsachen (Ergaenzungsheft, Stimmen aus Maria-Laach Nr. 106). Freiburg, 1911.

Gutberlet, K.
Der Mensch. Paderborn, 1911.

Hesse R. and Doflein F.
Tierbau und Tierleben. 2 vols. B. G. Teubner, Leipzig and Berlin, 1910-1914.

Hodge, C. F.
Nature and Study of Life. Ginn and Co., Boston.

Huxley, T. H.
The Cray Fish. An introduction to the study of zoology. Appleton, N. Y.

Koschel, J.
Das Lebensprinzip. Koeln, 1911.

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Zoologisches Praktikum. Gustav Fischer, Jena, Achte Auflage, 1920.

Lee, A. B.
The Microtomist's Vade-Mecum. 7th Edit. London, 1913.

Lloyd F. E. and Bigelow, M. A.
The Teaching of Biology. Longmans, Green and Co., N. Y.

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La Definition de la vie. Louvain, 1898.

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Psychologie.

Obermaier, H.
Der Mensch der Vorzeit.

Ranke, Johannes.
Der Mensch. Bibliographisches Institut. Leipzig und Wien, 2 vols., 1911.

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Zoologisches Praktikum. Leipzig, 1910.

Sedgwick, and Wilson.
General Biology.

Spencer, Herbert, E.
Principles of Biology. Rev. Ed., 1889. Appleton, N. Y.

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Elemente der Tierphysiologie. Jena, 1916.

Schwertschlager, Joseph.
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Instinct and Intelligence in the Animal Kingdom. B. Herder, St. Louis, 1903.

Wassmann, Erich, S. J.
Psychology of Ants and Higher Animals. B. Herder, St. Louis, 1905.

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The Problem of Evolution. B. Herder, St. Louis, 1912.

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The Cell in Developement and Inheritance. 2 Ed. Rev. and enlarged. The Macmillan Co., N. Y., 1914.

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The Church and Science. Herder, 1917.

Zittel, K. A. V.
Grundzuege der Palaeontologie. Munchen und Berlin, 1918-1919.

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Applied Biology. Macmillan, N. Y., 1911.

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Introduction to Biology. Macmillan, N. Y., 1913.

Hunter, G. W.
Essentials of Biology. American Book Co., N. Y.

Hunter, G. W. and Valentine, M. S.
Laboratory Manual of Biology. Holt, N. Y.

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Biology and its Makers. Holt, N. Y., 1908.

Parker, T. J. and W. N.
An Elementary Course in Practical Zoology. Macmillan, N. Y.

Peabody, J. E. and Hunt, A. E.
Elementary Biology, Plant, Animal and Human. Macmillan, N. Y.

Sharpe, R. W.
A Laboratory Manual for the Solution of Problems in Biology. American Book Co., N. Y.

Smallwood, W., Revely, Ida, and Bailey, G. A.
Practical Biology. Allyn and Bacon, Boston, 1916.

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Colton, B. P.
Zoology, Descriptive and Practical. Parts I and II in one volume. Heath, Boston, 1887.

Davenport, C. B. and G. C.
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Hegner, R. W.
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Animals. Appleton, N. Y.

Landacre, F. L. and Barrows, W. M.
An Elementary Laboratory Guide in Zoology.

Linville, H. R. and Kelly, H. A.
A Textbook of General Zoology. Ginn, Boston, 1906.

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A Textbook of Zoology. 2 vols. Macmillan, N. Y., 1910.

Thompson, A. J.
Outlines of Zoology. Appleton, N. Y., 3d Edit., 1899.

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Botany for Secondary Schools. Macmillan, N. Y., 1913.

Campbell, D. H.
A University Textbook of Botany. Macmillan, N. Y., 1902.

Coulter, J. M., Barnes, C. R., and Cowles, H. C.
A Textbook of Botany for Colleges and Universities. 2 vols., American Book Co., N. Y., 1911.

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Pearce, R. G. and Macleod, J. J. R.
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Shafer, E. A., Editor.
A Textbook of Physiology for Advanced Students. 2 vols., Macmillan, N. Y.

Verworn, M.
General Physiology. Tr. by Lee, F. S. Macmillan, N. Y., 1899.

GENERAL SCIENTIFIC PERIODICALS

The General Science Quarterly.
State Normal School. Salem, Mass.

Nature.
A weekly, illustrated journal of science. Macmillan, London and N. Y. $14.00.

Popular Science Monthly.
225 W. 39th St., New York. $2.50.

School Science and Mathematics.
2059 E. 72nd Place, Chicago. Monthly.

Science.
Garrison-on-Hudson, N. Y., or Substation 84, New York City. Weekly. $6.00

American Journal of Science.
New Haven, Conn. $6.00.

The Scientific American.
Munn and Co., N. Y. $4.00.

The Scientific Monthly.
(Formerly entitled The Popular Science Monthly). Garrison, N. Y. $5.00.

Proceeding of the National Academy of Sciences.
Washington, D. C. Monthly. $5.00.

BIOLOGICAL

Bird Lore.
Macmillan, N. Y. Bimonthly.

The American Botanist.
Willard N. Clute, Joliet, Ill. Quarterly. $1.50.

The American Naturalist.
Garrison, N. Y. Monthly. $5.00.

The Botanical Gazette.
University of Chicago Press, Chicago, Ill. Monthly. $9.00.

The Nature Study Review.
Ithaca, N. Y. Monthly. $1.50.

The Plant World.
Tucson, Ariz. Monthly.

Torreya.
The Torreya Botanical Club, Columbia University, N. Y.

PHYSICAL AND MECHANICAL

Everyday Mechanics.
33 W. 42d St., New York City.

Popular Mechanics.
6 N. Michigan Ave., Chicago.

Science Abstracts.
Section A—Physics. Spon and Chamberlain, New York. Monthly.

The Electrical Experimenter.
233 Fulton Street, New York City.

The Physical Review.
The American Physical Society, Ithaca, N. Y. Monthly.

The Wireless Age.
42 Broad St., N. Y. Monthly.

CHEMICAL

Chemical Abstracts.
Semi-Monthly.

The Journal of the American Chemical Society.
Monthly.

The Journal of Industrial and Engineering Chemistry.
Monthly.

The three journals are published in Washington, D. C. The annual subscription price for the three is $18.00, for two $13.80, for one $7.50.

Scientific Research

Scientific research is not, and should not be, our chief aim in teaching the sciences in our seminaries and clericates. Frequently years and years of intense study and close observation are required to score a telling point in some line of scientific investigation; and of course all this can not be required of our students and clerics, whose time is very much occupied with other work. Hence success in scientific research is for us something altogether too uncertain to be made a dominant purpose. We must aim at something which we can safely hope to attain. Our chief aim must always be to acquaint the students with the fundamentals and to give the great outlines and general principles of science; in other words, to spread out before their view a panorama of God's visible creation, and to explain the principles underlying its operations, without, however, detracting from the beauty of the whole by a too close and exclusive scrutiny of any single part.

Let it not be understood, however, that I wish to exclude scientific research; far from it. Though it does not deserve to be made our chief aim, it should nevertheless not be neglected. For even if we can not attain the final end for which scientific investigations are generally made, we can nevertheless derive various good results from them. Let me enumerate just a few.

In the first place, scientific research will deepen the interest of both teacher and students. To plod one's way through

voluminous textbooks and to memorize countless laws and principles of science without the saving feature of experimentation accompanying and enlivening this wearisome theorization, would indeed become a heavy burden to the teacher as well as to the students. But a moderate admixture of scientific research will sustain a lively interest, and will, moreover, aid immensely in the full and complete understanding of the theory.

Deepens Interest

While being thus, in one sense, merely an aid to the understanding of the theory, scientific research has also a field properly its own. For it offers to interested and ambitious students an opportunity to become acquainted with the methods of modern scientific research; and such knowledge is surely not to be despised in our age when the sciences are coming daily more and more into the foreground.

Trains in Methods of Investigation

Although it has been stated above that scientific discoveries should not be the chief aim of our experimentation, this does by no means exclude the possibility of such a valuable discovery on our part; especially since there are so many unsettled questions in the various branches of science. Take, for instance, the biological field — how many diseases are there due undoubtedly to disease germs which have not yet been isolated; and what about the cause, the nature, and the treatment of cancer? Any discovery bearing on such important questions — whether the result of long and intense study or merely of some accidental but close observation — would be of untold benefit to the entire human race; and even the mere possibility of such a good fortune ought to be an additional incentive for us to take interest in this line of work.

May Lead to Valuable Discoveries

Our application to scientific research will, moreover, tend to silence the accusations made by our enemies, that there is no productive work in Catholic circles. It will, to a certain extent, put us on a par with the foremost scientists, and will thus command, if not always their good-will, at least their respect. And just under this head it may be well to remark that many of our modern atheistic and materialistic scientists base all the arguments they level against the Church, on scientific grounds; and if their grounds remain for us an undiscovered territory, the

Will Silence Our Adversaries

Catholic defence will indeed be, or at least seem in the eyes of the world to be, rather weak. If, however, we are proficient also in this line, then we shall be able to meet these scientists on their own ground, to estimate correctly, and to rectify, if necessary, their statements regarding certain discoveries, especially if these seem to be at variance with generally accepted views.

Thus we see that various great advantages accrue from scientific research. And it is also in perfect harmony with the best traditions of the Church and of our glorious Order. Great is the number of our fellow-religious who have, in the course of seven centuries, rendered valuable services in the field of science; and we Franciscans have the singular honor to number as one of our own Fr. Roger Bacon, universally acknowledged the "father of experimental science."

But while, on the one hand, we contemplate the many advantages accruing from scientific research, there quietly steals upon us, on the other hand, the all-important question: "Is it possible?" Taking all circumstances into consideration, can we afford to take up scientific research work? I reply: "Yes, it is not only possible, but comparatively easy."

Scientific Research Possible

In the first place, the equipment of our laboratories need not be excessive. Not the over-abundance of equipment, but the intelligent use of a meagre equipment characterizes the real scientist. And to show you what can be accomplished with the most meagre equipment, let me relate to you the interesting story of Mendel, whose theory of inheritance, known as Mendelism, dominates the biological world of the present day. Johann Mendel, in religion known as Fr. Gregor Mendel, was an Augustinian monk at the convent of Bruenn, in Moravia. After completing his classical course at the gymnasium at Troppau and his theological studies at the convent of Bruenn, he pursued, for two years, courses in mathematics, physics, and the natural sciences at the University of Vienna. Shortly after, he was appointed professor at the technical school at Bruenn, and here he remained for fourteen years. During this time Mendel made experiments in hybridization with peas and beans and also in the crossing of bees; not with the aid of a fully-equipped laboratory, but with practically nothing at his disposal but the plain, simple convent garden.

And in spite of all these disadvantages, Mendel first gave to the world a definite statement concerning the secrets of heredity; and Mendel's "Laws of Heredity" have, within the last twenty years, exerted a more powerful influence than the much vaunted work of Charles Darwin. From this we also see that success in experimentation lies not so much in the abundance of equipment as in the intelligent and accurate observation of the experimenter.

Moreover, scientific research will not be such a tedious and lonesome task as it may seem to be. It can become, and will become, practical and interesting in the highest degree. Take up scientific research in any field, and I assure you, that outside assistance will be forthcoming. For no matter in what line of investigation you specialize, you will always have at your attention — and at your assistance, if you require it — some class of people, be they chemists, photographers, physicians, surgeons, or men engaged in any one of our scientifically conducted modern industries. For to such men the least improvement may mean immense gain; and if anyone gives good indication of probable success, these persons will be only too anxious to coöperate and even to lend financial aid.

But of couse, to make our scientific research work look in any way promising and really worth while, the "conditio sine qua non" is the efficiency of our teachers. Now it stands to reason that no teacher can be fully efficient and keep his class really interested in his subject, unless he is able to give a satisfactory answer to any incidental question that may come up; and for this he needs a thorough and comprehensive knowledge of his particular science. Hence the first thing necessary is the thorough training of our teachers. At some future period, when we have the sciences well established and arranged in our seminaries and clericates, we can, of course, train our own teachers; at least to such an extent that just a summer course at some university will make them fully competent to teach. But now as for making a beginning — for we want a successful beginning or none at all! — I see only one solution to the problem, and that is: to pick out our prospective teachers, and to give them the advantage of a thorough and complete course in their respective sciences at some high-standard university. These teachers will then in their turn be able to give their class a good foundation in the sciences, and

what a good foundation in any branch of learning means to a student you all know from personal experience.

Finally, the question may come up, what problems of investigation would be most suited to our conditions. If the question is meant to imply that no problems will present themselves, it is badly out of place; if the implication is that the great number of interesting problems will make a choice difficult, it must be dealt with. There are so many aids to answer this question, that we need not worry in the least. In the first place, the teachers themselves, in the course of their studies, will gradually be able to judge which problems are the best suited; whilst later on, suggestions of such a nature are most gladly given by the former teachers at the universities. Then our acquaintance and intercourse with scientific men of local universities and technical schools, with members of the medical profession, especially at hospitals, and with leading men in large industrial establishments—all this will aid us in choosing the right problem for experimentation. And finally, let us not forget coöperation among ourselves! Who has the first right to learn of our activity, our past successes, and our projects for the future, if not our own confrères both at home and in the other provinces? Who could be more interested in our work and more willing to give us good suggestions if possible, than our own brethren in religion? With this spirit of coöperation among ourselves, we can make scientific research work not only most interesting for all concerned; but we can, in a comparatively short time, so improve our seminaries and clericates that they will compare favorably also in the natural sciences with any secular institution of learning.

Problems

DISCUSSION

FR. SIMON:—What impressed me most favorably in Fr. Aloysius' paper is the moderation in his demands. Some scientists, even among the Friars, would seem to have in mind the laboratories of Columbia or Harvard when making up a list of their laboratory requirements. They have even quoted in support of their demands the saying of our late Vicar General, the Most Rev. David Fleming, O. F. M., "A Franciscan must be poor, but must not study poorly." Fr. Aloysius, however, does not demand more than is within the means of our Provinces.

Laboratory Equipment

The paper has thus escaped the danger of attaching too much importance to elaborate equipment. A laboratory is, indeed, essential,

but great things have been accomplished in science even with meagre equipment. The work of Abbot Mendel is a case in point. Fabre, too, the Homer of the insect world, labored amid poverty, and was sixty years old before he ever secured his "laboratory" at Serignan. The house he purchased there was a villa of two stories, standing in a plot nearly the size of an acre, the whole surrounded by a high stone wall. Visitors described the garden as a "veritable jungle, but a naturalist's paradise." Here Fabre transplanted many alpine and other types of plants. Here he arranged an outdoor pool, experimental tanks and cages. These, with apparatus of the simplest sort, formed the "laboratory" in which he investigated the hundreds of insects immortalized in the "Souvenirs." In these labors he was assisted at various times by his brother and seven children.

School Museums

FR. FELIX:—While American schools have emphasized laboratory methods they have done less than European schools to utilize illustrative materials. The school museum should be utilized for teaching all subjects, but it is the science teacher who will need it most. There is a saying that the usefulness of the school museum is in its making, and this is true of the collections made by the pupils. But the axiom is only of partial application, for the school museum should grow from year to year and receive adult curatorship. The school museum may well be administered along with the library, since it is a library of objects.

The "Cyclopedia of Education" enumerates the following among the essentials of the school museum: A well lighted room with (a) a few exhibit cases of suitable height for changing displays, arranged now by the librarian or curator, now by this class or that as illustrative problems for the enjoyment of the whole school; and (b) ample storage facilities for the systematic care of 1) pictures, photographs, magazine illustrations in properly indexed vertical-file drawers; 2) lantern slides arranged on shelves in long boxes which convert them into vertical-file records as easily classified as a library card catalogue itself; similarly, stereoscopic views, and a set of illustrations for the projectoscope if the reflecting lantern is used; 3) a collection of objects, minerals, woods, and other nature materials, textiles and other industrial materials, models, maps, charts, etc., stored compactly and systematically in drawers and cupboards without display; and 4) living exhibits, a vivarium to include plants, animals, birds, fish, etc., especially in urban schools. For the objective collections there is perhaps no better method of classification than by general subject numbers, as, e. g., in the Dewey library classification, with sequence numbers 1, 2, 3. . . within groups; or sequence numbers alone may be used. In either case a card catalogue with direct and cross references will be useful, and in a large collection indispensable. Such a school museum is 1) a supply bureau for illustrative materials to be taken into classrooms and used in teaching; 2) a room where pupils may secure information at first hand from concrete materials, as in the library from books; 3) a display room for changing exhibits (the fixed unchanged exhibit, be it of ever so much initial interest, is soon dead material); and 4) an important avenue for the expressive activity of pupils in organizing exhibits for their own schoolrooms, or within the museum itself.

The science teacher may also find it helpful to have at hand in the classroom a collection to which he may turn for reference or

illustration. Such a collection merits suitable accomodation: a good-sized cupboard with glass doors above for display, a vertical-file drawer 11 by 14 inches at least in section, with alphabet guides for the picture collection, and other drawers both shallow and deep for the storage of objects. Such a room collection will furnish material of increasing value each year for illustrating topics in the course of study and for arranging occasional small exhibits by the pupils, who will get valuable training in its care as well as knowledge by its use.

These schoolroom collections will appeal to most pupils. We are familiar with the tendency of pupils to become absorbed in the collecting of stamps or coins or natural history specimens. We should take advantage of the tendency for educational purposes. At St. Fidelis' Seminary, Herman, Butler Co., Pa., the Rev. Cornelius Pekari, O. M. Cap., succeeded after years of patient collecting in enriching the local museum with a collection that is fairly representative of the fauna of Butler County.

With a little encouragement on our part something worth while may thus be accomplished in the way of making collections. The Capuchin Monastery at Cumberland, Maryland, boasts a valuable paleontological collection made by a few theology students who happened to be interested in geology. Specimens illustrating the Devonian and Silurian Periods are catalogued to the number of three thousand. The collection has received considerable recognition in the publications of the Maryland Geological Survey. University professors have been attracted by the collection to make a study of the territory which is rich in prehistoric fossils.

A Paleontological Collection

For the theology students who did the collecting on their holiday excursions, the work was more fruitful in results than formal instruction. It was the method employed by Agassiz for teaching science. The work may have influenced only indirectly the entire student-body, but it accomplished a worthy purpose if it spurred even only one in every class to raise himself above the dead level of the ordinary. Nor did the geology studies interfere with the vocational pursuits. The professors of theology were the very ones who encouraged the scientific work of the young men. They rightly felt that here was an opportunity for awakening latent ability, and for solving the vexing problem of giving the clerics some intellectual pursuit for their leisure hours.

FR. ALOYSIUS:—It is upon request that I am appending herewith an additional list of scientific periodicals.

SCIENTIFIC PERIODICALS

Journal of the Franklin Institute.
Monthly. Philadelphia, Pa. $6.00.

Bulletin of the Brooklyn Institute of Arts and Sciences.
Brooklyn, N. Y. $2.00.

Journal of the Worcester Polytechnic Institute.
Quarterly. Worcester, Mass. $2.00.

West American Scientist.
Monthly. La Jolla, Cal. $3.00.

Science.
Weekly. Garrison, N. Y. $6.00.

Ohio Journal of Science.
Monthly. Columbus, O. $2.00.

Philippine Journal of Science.
Monthly. Manila. $5.00.

Museum Journal.
Quarterly. Philadelphia, Pa. $2.00.

Natural History.
Bi-monthly. New York, N. Y. $3.00.

Annual Report of the Smithsonian Institution.
Government Printing Office, Washington, D. C.

American Journal of Mathematics.
Quarterly. Baltimore, Md.

Guide to Nature.
Monthly. Sound Beach, Conn.

Journal of Geology.
Semi-quarterly. Chicago, Ill.

Chemical Age.
Monthly. New York, N. Y.

Illinois Chemist.
Quarterly. Urbana, Ill.

American Journal of Botany.
Monthly. Brooklyn, N. Y.

Publications of the New York Botanical Gardens.
Bronx Park, New York, N. Y.

Missouri Botanical Garden Bulletin.
Monthly. St. Louis, Mo.

American Midland Naturalist.
Bi-monthly. University of Notre Dame, Notre Dame, Ind. $1.50.

Botanical Abstracts.
Monthly. Ithaca, N. Y.

Zoölogical Society Bulletin.
Bi-monthly. New York, N. Y.

Journal of Experimental Zoölogy.
Eight issues a year. Philadelphia, Pa.

Journal of Entomology and Zoölogy.
Quarterly. Claremont, Cal.

Transactions of the American Entomological Society.
Quarterly. Washington, D. C.

Journal of Bacteriology.
Bi-monthly. Baltimore, Md.

Abstracts of Bacteriology.
Monthly. Baltimore, Md.

Journal of Heredity.
Monthly. Washington, D. C.
Genetics.
Bi-monthly. Brooklyn, N. Y.
American Journal of Hygiene.
Bi-monthly. Baltimore, Md.
Physiological Review.
Quarterly. Baltimore, Md.
American Journal of Physiology.
Monthly. Baltimore, Md.
Journal of Comparative Neurology.
Bi-monthly. Philadelphia, Pa.
Journal of Biological Chemistry.
Monthly. Philadelphia, Pa.

REPORT OF THE COMMITTEE ON RESOLUTIONS

The Committee on Resolutions of the Franciscan Educational Conference begs leave to submit respectfully the following resolutions:

1. To the Most Rev. Fr. Joseph Anthony a Persiceto, O. M. Cap., Minister General of the Capuchin Friars Minor, and to the Most Rev. Fr. Dominic Tavani, O. M. C., Minister General of the Conventual Friars Minor, we extend our warmest thanks for their encouragement of the work of the Franciscan Educational Conference.

2. Since the success of this year's Meeting is due in great measure to the renewed expressions of confidence and support given unanimously on the part of our Provincial Superiors in favor of the educational work of this Conference, we beg leave to express to each and every one our sincere gratitude, and to submit the results of our deliberations to their serious thought and prudent judgment.

3. The Conference appreciates highly the interest which the secular and regular clergy of the United States and other countries, and educators generally have shown in its proceedings, and to which they have given expression in numerous communications addressed to the Secretary during the past year.

4. The Conference feels deeply grateful for the fraternal hospitality tendered to the Delegates by the Superior and community of Our Lady of the Angels during this year's Meeting.

5. The revelation of the scientific achievements of the Friars of the past is an inducement to the Friars of the present to live up to the traditions of the Order by fostering in themselves and in their charges a deep and serious love for the study of the sciences.

6. The Conference wishes to express its conviction that there is no opposition between the study of the sciences and the other branches of knowledge. Rather, a judicious correlation of the science course with both the classical and philosophical courses is considered beneficial in developing that culture and balance of mind which should be the end of all true education.

7. We endorse the suggestions offered by the Committee on Program with regard to the place that the sciences should hold in our curriculum. We trust that the broad modifications adopted will at the same time measure up to the standard demanded by scientists, and also meet the conditions obtaining in the several Provinces.

8. We are deeply convinced that the study of the sciences can not advance to any considerable degree without necessary equipment. Consequently we earnestly petition our Provincial Superiors to continue their generous policy of providing our various educational institutions with such apparatus as is necessary or highly useful in facilitating the teaching and the study of the sciences in our curriculum.

Moreover, we feel the need of having our teachers in the sciences specially trained for their work. We are therefore sincerely grateful to our Superiors for having inaugurated the practice of sending our young men to standard centers of learning in order that they may equip themselves for effcient work in this field.

9. We unanimously approve the plan of publishing the "Franciscan Studies," intended to be a series of monographs of scholarly worth and cultural interest. We are confident that this enterprise will meet

with the hearty approval of our Superiors; and we invite the Friars of the various Provinces to cooperate in making this undertaking a success.

10. We offer cordial congratulations to the Friars who are so successfully employing the power of the pen to promote the cause of the Church and the Order. We rejoice over their success in upholding so nobly the Franciscan traditions of scholarship and literary craftsmanship, and we hope that many of our Brethren will pay them the sincerest compliment of imitation.

11. The rich fruits accruing from the deliberations of the Franciscan Educational Conference warrant us in recommending to our Friar educators generally the advisability of holding meetings for the purpose of discussing pedagogical topics. The formal and informal exchange of views provided for in such faculty conferences, to be held, if possible, at periodical intervals, will unquestionably redound to the further improvement of our Franciscan schools.

12. The example of the painstaking efforts of some Friars to bring to light the Incunabula and Manuscripts hidden away in the libraries of their respective Provinces should be a powerful incentive to all our librarians to cooperate promptly and generously with the scholarly efforts of the Rev. John M. Lenhart, O. M. Cap., to have ready for next year's Meeting a complete census of the Incunabula, Post-Incunabula, and Manuscripts preserved in our Friaries.

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